Vol. XXVIII. Part 9.

NATIONAL MUSEUM OF VICTORIA

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The Journal of the Department of Agriculture of Victoria, Australia.

Sept., 1930.

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THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE

VICTORIA, AUSTRALIA.

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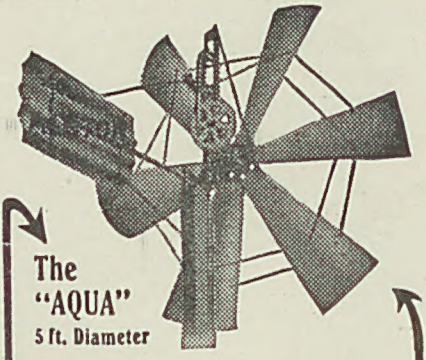

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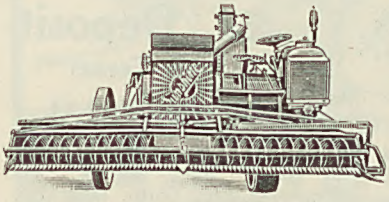

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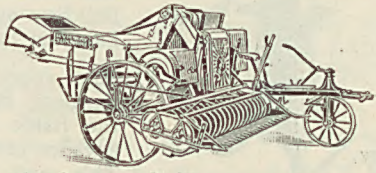

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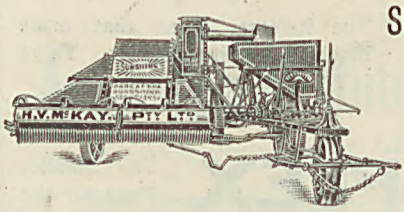

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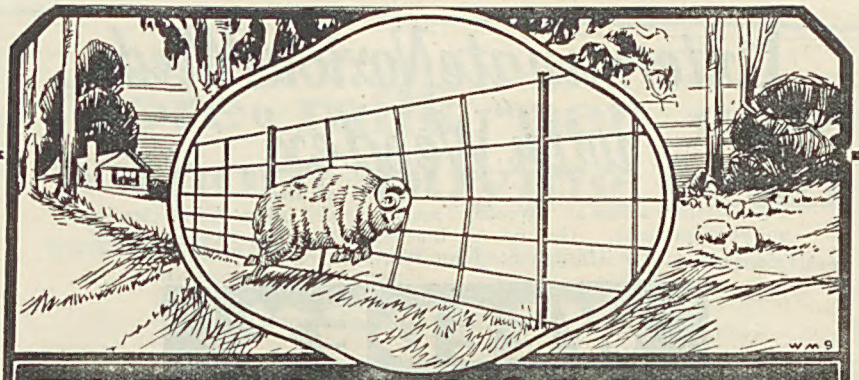

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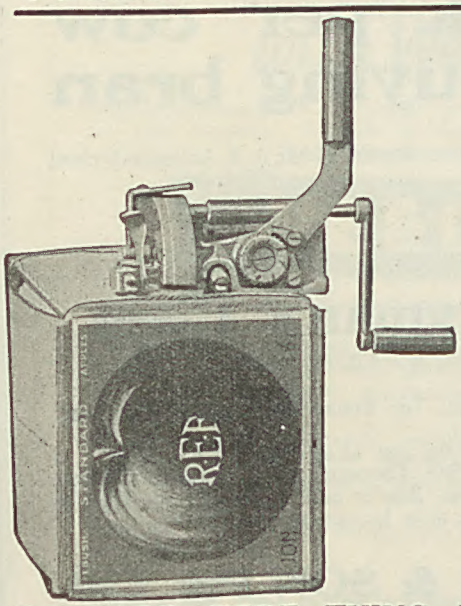

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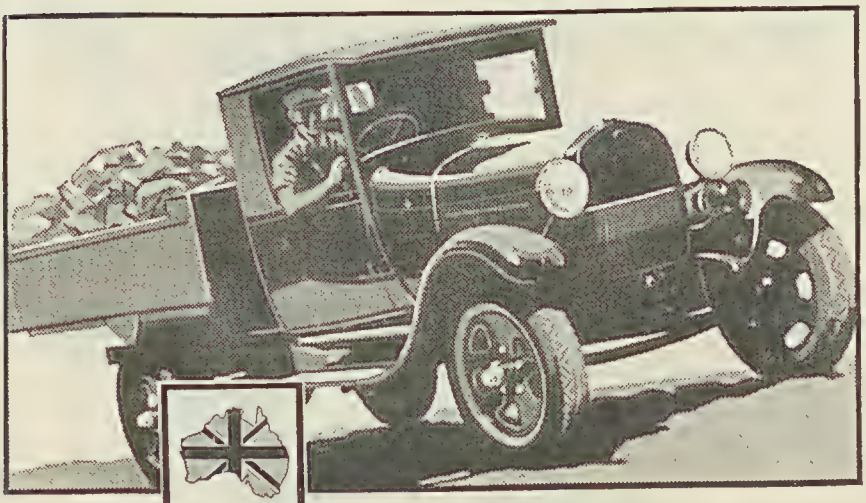

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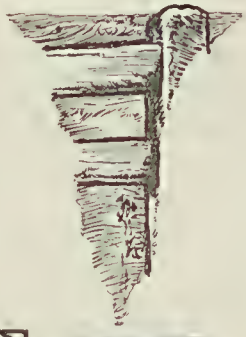

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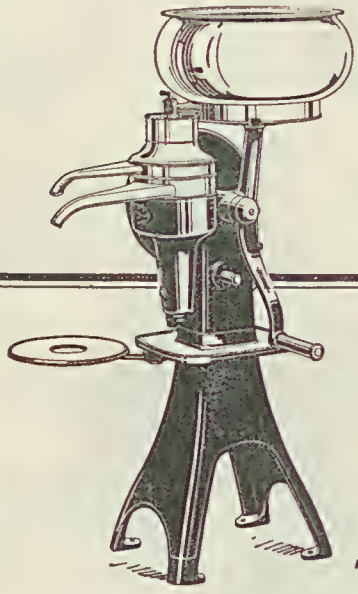

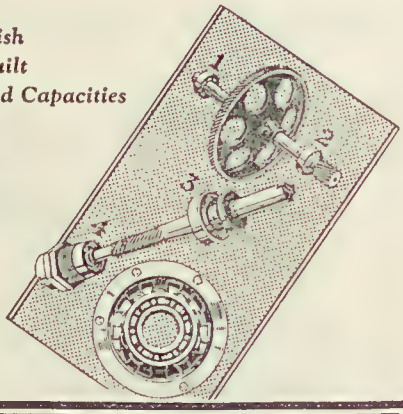

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THE JOURNAL

OF THE

Department of Agriculture

OF

VICTORIA.

Vol. XXVIII September, 1930. Part 9

FOR many years past the Department of Agriculture has arranged a Farmers' Field Day at the State Research Farm at Werribee during Show Week. This year the Field Day will be held on the 26th September, and a guide book, setting out the purpose of the farm, the nature of the experimental work and the conclusions from experiments so far carried out, has been prepared for distribution. As the information included will be of interest to many who will not have the opportunity of attending the Field Day, it has been decided to devote the Journal for this month to a reprint of the Guide Book.

10515.—1

STATE RESEARCH FARM, WERRIBEE.

The Purpose of the Farm.

The State Research Farm was established to provide, for permanent use by the Department of Agriculture, a farm on which to carry out research work, experiments, and practical demonstrations in all branches of agriculture and live-stock husbandry.

The work carried out reflects the teachings and experience of the staff of the Department, and is designed to insure in its results the promotion of sound and advanced agricultural practice suitable to the present and probable future circumstances of the State.

The purpose of the farm is not to attain financially profitable results so far as the farm itself is concerned, but to confer on agriculture the benefits of modern scientific advances by the prosecution of investigations and trials under practical and accurately-recorded conditions concerning the problems involved in increasing the agricultural output of the State, particularly as regards—

(*a*) Improvement of wheat and other cereals, grasses, and economic plants by selection and hybridization;
(*b*) Soil renovation, fertilizing and tillage methods;
(*c*) Rotation of crops and improved cropping practices;
(*d*) Irrigated crops—particularly lucerne and pasture;
(*e*) Improvement of natural pastures by top-dressing, and trials of artificial grassing with exotic and native grasses;
(*f*) The breeding and feeding of live stock, and improvement of milk yields;
(*g*) Research concerning soil moisture, temperatures, biological conditions, and nitrification processes; the nutrition of plants; control of weeds, &c.;
(*h*) Meteorological observations relating to agriculture.

Location, Area, and Character of Soils.

The location has many advantages. Among them is the handiness of the area to Melbourne (18 miles), whereby close touch by the Department is facilitated, and easy access by farmers from all parts of the State is afforded. The proximity to Werribee railway station (1 mile), the long stretch of observation obtainable from the railway and Geelong-road, the fact that both dry farming and irrigation areas are in proper proportion, and also that comparatively good land and definitely poor land are included, are combined advantages that could not be secured elsewhere in the State. Much of the soil closely resembles in physical character and chemical analysis that of the Goulburn Valley and Northern cereal-growing districts.

The area of the farm is 2,211 acres, of which fifty per cent. is poor to fair, volcanic loam, stony in patches, overlying grey-blue pug clay; twenty-five per cent. is patchy, crab-hole, dark-brown to grey clay land overlying grey-blue pug clay. The balance, some 500 acres, is more

or less of an alluvial nature on the surface, and is also overlying the common sub-soil of the district. This latter area is irrigable, and commanded by the main farm channels.

Prior to the establishment of the farm, a considerable area of the land had been subjected to continuous cropping with hay crops, and some of the best land is known to have grown cereal crops continuously for 26 years. The deficiency of humus, indicated by the floury character of the soil after dry cultivation, and the hard setting on drying after rain, is also made apparent by the contrast between the paddock soil and that on the removed fence lines.

Subdivision and Developmental Work.

Possession was taken from the Closer Settlement Board on 1st July, 1912, of the original farm of 1,167 acres, and at that time the area comprised five large paddocks, of irregular shape, bounded by indifferent fences and stone walls.

Since this date the farm area has been increased to 2,211 acres by a further purchase on the north-eastern side of the original farm. The plan at the end of this book shows the subdivisions and improvements which have been carried out to date. Primarily, the area of 1,167 acres was divided by north-south and east-west roads into four divisions, designated respectively N.E. (north-east), N.W. (north-west), S.E. (south-east) and S.W. (south-west).

The last area purchased, 1,044 acres, has been subdivided into paddocks suitable in the north section for dry-farming operations, while the eastern and south-eastern sections of, approximately, 200 acres, have been graded, and sown to English grasses and clovers. They are irrigable and are subdivided for stock purposes, into areas from 12 acres upwards.

For the most part, the original area has been divided into fields of rectangular shape, comprising areas of 10 acres, or multiples of 10, in order that calculations and comparisons of crop yields may be facilitated.

In subdividing the farm, attention has been paid to securing, as far as possible, an even quality of soil for each set of permanent experiments, and also to the balancing of distances in relation to the farmsteading, which occupies a site on the highest level, and has drainage falls in four directions.

School of Agriculture.

By an arrangement made with the Faculty of Agriculture of the Melbourne University, undergraduates taking the course for the degree of Bachelor of Agricultural Science enter into residence at the Research Farm for the second year of their course, in order to undergo training in practical agriculture. This comprises oral instruction in farming methods and animal husbandry, as well as participation in exercises of a technical nature. Comfortable quarters have been erected in which the students reside, but one day each week they visit the University for the purpose of keeping in touch with the educational activities there. The farm, embracing, as it does, experiments in dry farming, irrigated agriculture, and live stock husbandry, as well as ordinary farming on a large scale, offers special advantages for the practical training of students of University grade.

Ploughing, State Research Farm.

Summary of Cropping, 1930.

This season, 1,333 acres are under crop, 60 acres are in summer fallow, and 517 acres in ordinary winter fallow. The cropped area is made up as follows:—

Wheat for seed	212 acres.	
Oats for seed	50 „	
Barley for seed	60 „	
Oats and wheat, mixed, for hay	203 „	
Cereals for ensilage and green feed	36 „	
Oats for hay	180 „	
		741 acres.
Irrigated lucerne Irrigated sown grasses	400 „	
		400 „
Experimental plots	192 „	
		192 „
Total		1,333 acres.

The experimental area comprises 292 acres, of which approximately 100 acres are included in the fallow above, and 192 acres are occupied as follows:—

Rotation trials	18 acres.
Green manurial and feeding-off tests	20 „
Permanent fertilizer tests	14 „
Stud cereals and long rows	13 „
Seed, variety, and selection plots—Wheat	59 „
Seed and variety plots—Barley and oats	23 „
Miscellaneous cereal tests	9 „
Pickling tests	4 „
Pasture top dressings	12 „
Irrigation investigations	20 „
Total area	192 acres.

Seasonal Conditions.

The rainfall at Werribee for the past 50 years has averaged approximately 20 inches. Compared with the wheat belt, this rainfall appears at first sight to be adequate for heavy crop production. In point of fact, however, the rainfall at Werribee is less effective than a similar annual rainfall would be in the wheat belt of Northern Victoria.

The greater portion of the rain falls in light showers, which are frequently followed by strong winds, causing a large percentage of the moisture to be dissipated by evaporation. The average annual evaporation from a free water surface exceeds 45 inches per annum. The problem of conserving moisture in the soil for the use of crops is, therefore, quite as important at Werribee as it is in the driest parts of the wheat belt of Victoria.

The heavy rains of November and December of last year left the fallows well charged with moisture over the summer, and further work on them was permitted by a good fall of rain in the third week of February. Sowing of the hay areas was completed early in April under favorable conditions, and the crops have germinated and grown evenly and well. Heavy rain in the second week of May somewhat delayed the seeding of wheat, and eventually the seed was sown under wetter conditions than has obtained in seeding time for many years. Further rains in June, July and August have been more than sufficient for vigorous growth in crops, and the prospect for good harvest returns is bright. The rainfall to the 15th of August was 150 points above the average for the last 17 years.

Meteorological Observations.

Summary of observations made during 1928, and comparisons with averages of previous years:—

RAINFALL.

Average annual rainfall for forty-two years prior to 1913 ..	=	20·19 inches.
Rainfall during 1929	=	18·05 ,,
Rainfall 1930 to September	=	12.95 ,,

BRIGHT SUNLIGHT.

Average annual total during 15-year period 1914 to 1928	= 2,069·6 hours	= Daily Mean, 5·7 hours
Total during 1929	= 2,156·4 ,,	= Daily Mean, 5·9 ,,

EVAPORATION.

Average annual total from free water surface during 14-year period 1914 to 1928	=	46·5 inches.
Total during 1929	=	43.0 ,,

MEAN AIR TEMPERATURES.

Period.	Dry Bulb.	Wet Bulb.	Maximum.	Minimum.	Mean of Max and Min
Average for 15 years, 1914 to 1928 ..	58·5° F.	53·9° F.	67·3° F.	48·0° F.	57·6° F.
During 1929 ..	57·4° F.	52·4° F.	66·1° F.	47·2° F.	56·7° F.

MEAN SOIL TEMPERATURES.

Period.	At 1 Inch.		At 6 Inches.		At 12 Inches.		At 24 Inches.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
Av'ge for 15 years, 1914 to 1928	69·6° F.	51·0° F.	62·0° F.	54·8° F.	59·8° F.	56·1° F.	59·2° F.	57·2° F.
During 1929	71 9° F	48·8° F.	60·6° F.	53·8° F.	58·9° F.	55·0° F.	58·5° F.	56·6° F.

MEAN OF MAXIMUM AND MINIMUM SOIL TEMPERATURES.

Period.	At 1 Inch.	At 6 Inches.	At 12 Inches.	At 24 Inches
Average for 15 years, 1914 to 1928	60·3° F.	58·4° F.	58·0° F.	58·2° F.
During 1929	60·3° F.	57·2° F.	57·0° F.	57·6° F

EXPERIMENTAL WORK.

Since the inception of the farm, a considerable amount of attention has been given to field experiment work. The objective of the field experiments includes the determination of the most suitable types of crop rotation for districts similar to Werribee, kinds and quantities of fertilizers necessary to give the maximum net profit per acre, the cultural practices most suitable for the profitable growth of the various cereal crops raised in Victoria, and methods of restoring humus to wheat lands, &c.

On the irrigated area of the farm experiments have been conducted with lucerne and mixed pastures to determine the quantities of water required, the influence of fertilizers on the crop yields, and the best methods of maintaining heavy production.

The improvement of cereal crops by selection and hybridization is an important phase of the work, and many new and promising cross-bred wheats, oats, and barleys are undergoing trial prior to a more extended test throughout the State. Free Gallipoli, Rajah, Rance, and Sepoy, which comprise 55 per cent. of the State's acreage this year, were bred at this farm.

New Experimental Methods—"Replicated Plots."

For some time careful consideration has been given to the desirability of obtaining a greater degree of accuracy in comparative field tests at departmental farms. The principal methods employed in various institutions throughout the world have been investigated, and an accurate survey of the variation in yield of an apparently uniform acre of wheat made, Hall and Mercer's classic experiment at Rothamstead in 1911 being repeated. The results confirmed those obtained in England, viz., that greater accuracy may be obtained where the plots are—

(1) One-fortieth acre in area;
(2) of a long narrow shape;
(3) replicated at least five times, and preferably eight in each series.

As a consequence, a comprehensive trial of the Bevan half-strip method of conducting variety trials was instituted. Under this system each variety to be tested is sown closely adjacent to a standard variety. The pairs were repeated eight times.*

* For repetitions such as this the word *replication* has been coined.

The method largely increases the number of plots employed, but has the advantage that the influence of soil variations on the results can be detected and guarded against. The degree of accuracy of results can be ascertained statistically, and results may be rejected which do not come within certain prescribed limits of variation from the mean. It is expected that the new method will facilitate the detection of smaller differences between the true yields of varieties than has been possible hitherto. The initial trials have proved satisfactory, and a modification of the method has been adopted for yield trials on new crossbred wheats.

Outlines of Field Experiments.

The principal experimental work undertaken comprises:—

(1) *Dry Farming.*

Section 1.—Permanent Rotation Field.

Section 2.—Permanent Fertilizer Tests.

Section 3.—Green Manurial and Feeding-off Tests.

Section 4.—Stud Cereals and Crossbred Plots (Field 10a, S.E.).

Section 5.—Wheat Long Rows, Selection Plots, Variety Plots, Replicated Variety Tests, Seed Plots (Far Austral and North Railway).

Section 6.—Barley and Oat Variety Plots (Far Austral).

Section 7.—Miscellaneous Tests with Cereals (North Railway and Far Austral).

Section 8.—Bulk Cereals for Seed (North Railway and North Triangle).

Section 9.—Permanent Top-dressed Pasture Tests (Field 5, N.E.).

(2) *Irrigation Experiments.*

These included the following tests:—

Section 1.—Irrigated lucerne.

- (*a*) Influence of rate and frequency of watering on lucerne yields.
- (*b*) Influence of spacing of rows on production of lucerne seed.
- (*c*) Best time to cut lucerne.
- (*d*) Effect of various methods of renovation of lucerne.
- (*e*) Variety Trials.
- (*f*) Fertilizer Trials.

Section 2.—Irrigated grasses. Fields 2 and 5, S.W.; 3, 4, 5, 6, and 12A, S.E.; 3, N.E.; Near Sunrise and South Sunrise

DETAILS OF EXPERIMENTAL WORK.

DRY FARMING.

Section 1.—Permanent Rotation Tests.

The permanent rotation tests commence at the front entrance, and comprise a series of 35 plots.

Yields of Hay from half-acre Plots.

(1) Hay continuously.
(2) Hay after bare fallow.
(6) Hay after barley and bare fallow.
(8) Hay after barley and peas.

This series of plots may be described as a test of different systems of farming. Thirteen systems of crop rotation are being tested, and of these, Series 1-10 were commenced in 1913, and Series 11-13 in 1915.

The plots are permanent in character, and may be divided into two principal sections, in which the main crops are respectively wheat and oaten hay. The object of the test is to determine the most profitable system of rotation cropping for conditions similar to those at Werribee. As far as is possible, each crop receives the same treatment that it would get if it were growing on a large area. The financial returns from each plot are being determined by the keeping of accurate records, in which the cost of working each plot is entered at current market rates. To facilitate the calculation of the grazing values of fodder crops and pasture these plots are temporarily fenced, and records of the number of sheep grazed on each plot and the periods of grazing are obtained.

The treatment of each plot in the rotation field for the past four years is indicated on the labels in front of each plot. The white posts indicate the boundaries of each series of rotations. The rotation systems undergoing trial are—

1. Hay continuously—Plot 1.
2. Hay after bare fallow—Plots 2 and 3.
3. Hay after bare fallow and barley—Plots 4, 5, 6.
4. Hay after peas and barley—Plots 7, 8, 9.
5. Wheat after peas, barley, rape—Plots 10, 11, 12, 13.
6. The Wimmera rotation, bare fallow, wheat, oats, pasture—Plots 14, 15, 16, 17.
7. The Mallee rotation, bare fallow, wheat, pasture—Plots 18, 19, 20.
8. Wheat after peas and rape—Plots 21, 22, 23.
9. Wheat after bare fallow—Plots 24, 25.
10. Wheat continuously—Plot 26.
11. Wheat after peas and barley—Plots 27, 28, 29.
12. Wheat after peas and oats—Plots 30, 31, 32.
13. Wheat after rape and oats—Plots 33, 34, 35.

SOME RESULTS FROM THE ROTATION FIELD.

One outstanding result on the Permanent Rotation Field has been the marked increase in crop yield wherever either the oaten hay or the wheat crop was preceded by a well-worked fallow. In the case of oaten hay, the average increase in yield from bare fallow has been 22.0 cwt. per acre above the yield of the plot continuously cropped.

Table I.—Comparison of Yields of Hay after Bare Fallow with Hay Continuously (1914-1929).

Year.	Hay Continuously. Cwt. per acre.	Hay after Bare Fallow. Cwt. per acre.	Increase due to Bare Fallow. Cwt. per acre.	Net Value of Increase per acre, with Hay at £3 per ton.
				£ s. d.
1914 (drought)	15·3	31·7	16·4	2 9 2
1915	26·2	52·2	26·0	3 18 0
1916	24·2	52·1	27·9	4 3 8
1917	20·0	38·8	18·8	2 16 8
1918	39·5	71·9	32·4	4 17 2
1919	28·0	40·0	12·0	1 16 0
1920	13·9	51·4	37·5	5 12 5
1921	26·9	56·7	29·8	4 9 5
1922	23·5	46·1	22·6	3 7 10
1923	31·5	66·4	34·9	5 4 8
1924	31·8	40·0	8·2	1 4 7
1925	18·7	30·3	11·6	1 14 9
1926	21·1	32·3	11·2	1 13 7
1927	18·0	47·3	29·3	4 7 11
1928	24·8	36·8	12·0	1 16 0
1929	23·0	45·0	22·0	3 6 0
Average for 16 years ..	24·2	46·2	22·0	3 6 0

Assuming that these results hold equally well on large areas of land, it would mean that a farmer on land similar to Werribee might expect to obtain practically as much hay from 100 acres sown after bare fallow as from *double the area* cropped continuously.

Although the production would be the same in both cases, the net profit would be considerably greater in the case of the hay sown after bare fallow. Only half the area of land would need to be sown and harvested each year to grow the same tonnage of hay, and the quality is better. These advantages more than offset the extra cost of working the fallow.

Another interesting feature of the rotation results is the satisfactory yield of hay in the rotation, hay, barley, bare fallow. The average results from the four hay rotations are summarized in Table II., which gives also the average yield of barley and peas.

Table II.—Average Yield of Hay, Barley, and Peas on the Permanent Rotation Plots (Average of Sixteen Years).

Rotation.	Average Annual Yield for Fifteen Years.		
	Hay.	Barley.	Peas.
	Cwt. per acre.	Bushels per acre.	Bushels per acre.
1. Hay continuously	25·1 cwt.	..	..
2. Hay, after Bare Fallow	46·2 „	..	..
3. Hay, Barley, Bare Fallow	46·2 „	20·9	..
4. Hay, Barley, Peas	28·0 „	19·6	9·4

Section of the Rotation Field.
Showing plots of Bare Fallow, Wheat, Oats, and Pasture ("Wimmera" Rotation).

The results demonstrate that the yield of oaten hay when grown either after bare fallow or in a three-year rotation, as hay, barley, fallow, is twice that of the land growing hay continuously.

When grown in a three-course rotation with peas and barley, the average yield of hay was 28.0 cwt. per acre. It might have been expected that the yields of hay after peas would have been equal, at least, to the

Representative Samples from Rotation Plots.

1. Hay continuously.
3. Hay, after bare fallow.
24. Wheat after bare fallow.
26. Wheat continuously (practically all wild oats).

hay after fallow. That the yields of hay are considerably less would suggest that the extra soil moisture conserved by fallowing is of more importance to the hay crop than the extra nitrogen gathered by the peas.

The average yield of barley in the rotation—bare fallow, hay, barley —was 20.9 bushels, whilst in the rotation—hay, barley, peas—the average yield of barley was 19.6 bushels, and that of peas 9.4 bushels per acre.

Peas do not return satisfactory yields at Werribee.

The yields of wheat from the rotations most commonly practised in the State are recorded in Table III. below, and again emphasize the value of both a well-worked fallow and crop rotation.

Table III.—Average Annual Yield of Wheat over Period of Sixteen Years (1914-1929).

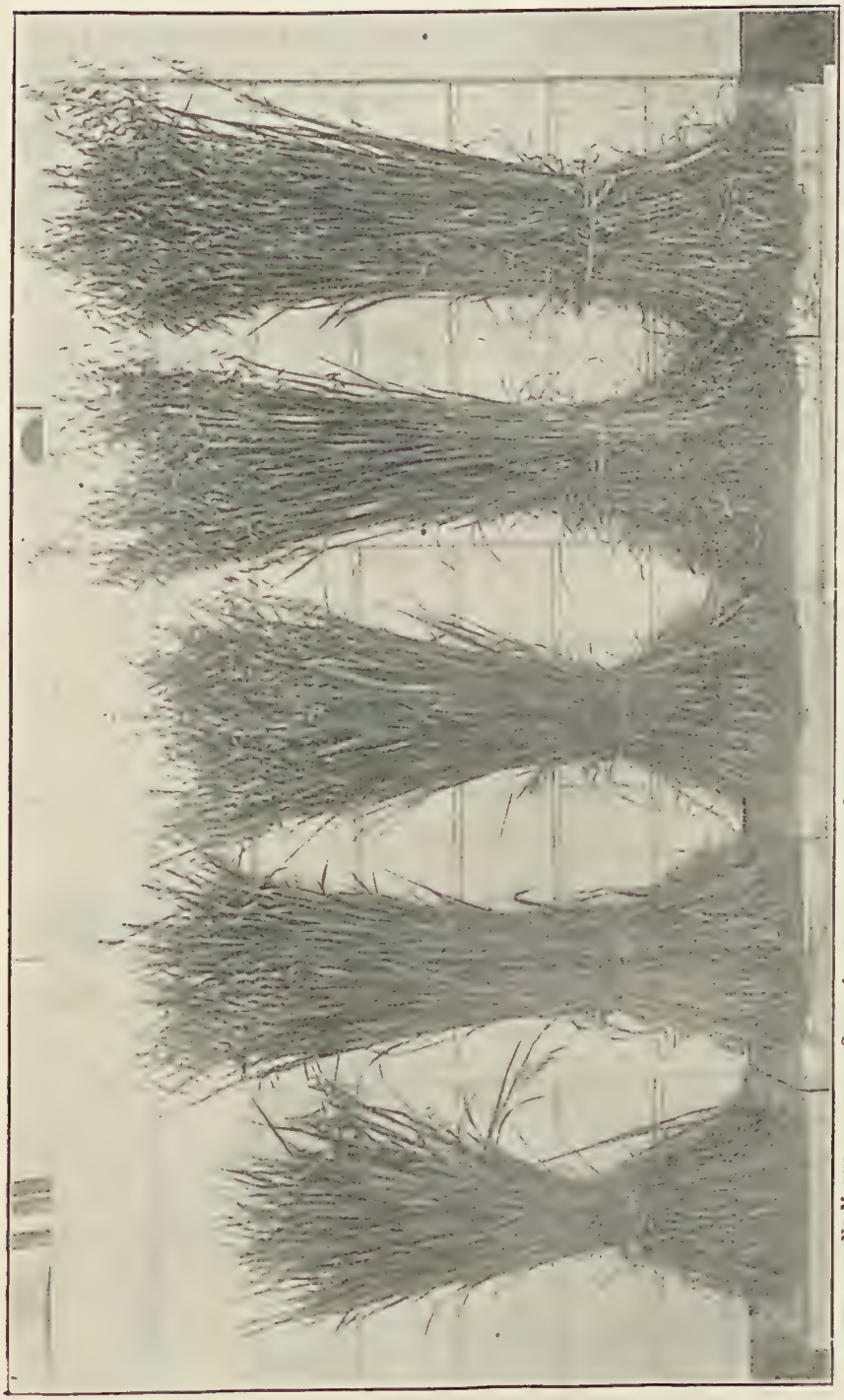
Rotation.	Bushels per Acre.
Wheat continuously	6·1
Rape, Barley, Peas, Wheat	11·7
Rape, Peas, Wheat	14·2
Pasture, Fallow, Wheat	17·2
Fallow, Wheat	18·0
Oats, Pasture, Fallow, Wheat	19·2

Section 2.—Permanent Fertilizer Trials.

When superphosphate was first introduced as a manure for wheat, and dressings of 56 lbs. per acre, and even lower than that, were advocated, to many it seemed beyond the bounds of common sense that so small a dose could appreciably affect yields. The grounds for this early scepticism are not hard to understand when it is remembered that the top 3 inches of soil weighs between 300 and 400 tons, and that actually only a fraction (about one-fifth) of the small dressing of manure is of direct benefit to the plant. To-day so widespread is the use of "super." on our Australian wheat soils and so consistent are the results, that the phenomenal response of the average soil to the manure has become commonplace, and it is only when the seed drill happens to miss sowing the regular quantity of manure that the farmer is reminded of the vital part this light dusting plays in producing profitable yields.

The Importance of Determining the Most Profitable Dressing.

The problem of to-day, therefore, is not one in which the advisability of the use of superphosphate is questioned, but rather to ascertain how much to use. It can be shown that this quantity varies with a number of factors, and that its determination with some degree of precision is a matter of considerable importance. Experiments show that on most soils there is a steady and proportionate increase in the yield as the amount of the manure applied is increased until a point is reached after which the same ratio is not maintained, and, eventually, there is no response to still heavier dressings. Obviously, then, in practice it is necessary to determine the manurial application which gives the greatest net profit, and this is not necessarily that which gives the highest yield. It will follow, also, that the higher the price of wheat the greater will be the profit per acre.



Representative Samples from Manurial Field, Showing Influence of Superphosphate in Hastening Maturity.
(Photographed in green state.)

LAY-OUT OF THE PLOTS.

Prior to 1921 the fertilizer trials comprised a series of 40 plots, of which, in any one year, 21 were sown regularly to wheat. The rest were in bare fallow. The plots were each ¼-acre in area, and were designed to be permanent, i.e., the same manurial treatment was to be continued on each plot indefinitely. With a view to determining the effect of these same fertilizers on oats the plots were halved in 1921—one half being sown to wheat and the other to oats. Thus there are now 80 plots each ⅛-acre in area. The permanent character of these plots makes them more important than the usual fertilizer trials. On every occasion on which the plots come under crop the manurial dressing applied to each is the same. The effects due to the different dressings of fertilizers are becoming more and more noticeable as the years go by, and interesting changes in the fertility of the soil in the various plots may be seen. Thus it is possible to determine not only the immediate effect of the various fertilizers, but the cumulative effect as well.

The average yields of wheat for the past fourteen years (excluding the years 1925 and 1926, when no manures were applied) are summarized in the table below.

TABLE I.—EFFECT OF FERTILIZERS ON YIELD OF WHEAT.

Application per acre.	For 15 years, 1913–1929.
	Bushels per acre.
Superphosphate 1 cwt.	16·4
Farmyard Manure 10 tons	14·0
Farmyard Manure 10 tons + Lime 10 cwt. ..	13·4
No Manure	6·8
Super. ½ cwt.	14·3
Super. 1½ cwt.	19·4
Super. 2 cwt.	19·7
Super. 1 cwt. + Nitrate Soda ½ cwt. (with seed) ..	17·6
Super. 1 cwt. + Nitrate Soda ½ cwt. (in Spring) ..	17·8
Super. 1 cwt.	17·2
Super. 1 cwt. + Sulp. Potash ½ cwt.	17·3
Super 1 cwt. + Sulph. Potash ½ cwt. + Nitrate Soda ½ cwt.	16·8
Bone Fertilizer 1 cwt.	10·2
Thomas's Phosphate 1 cwt.	11·6
Super. ½ cwt. + Thomas's Phosp. ½ cwt.	15·1
Super. 1 cwt. + Lime 5 cwt.	16·3
Super. 1 cwt. + Lime 10 cwt.	16·7
Super. 1 cwt. + Lime 20 cwt.	16·3
Super. 1 cwt.	15·2
No Manure (cropped continuously)	4·8
Super. 1 cwt. (cropped continuously)	8·4

Superphosphate 18% P_2O_5 used 1913-1924. Lime used was air-slaked.
,, 22% ,, ,, after 1926.

The following table summarizes the net profits from light and heavy dressings of superphosphate, bone fertilizer, and basic slag:—

Table II.—Heavy and Light Dressings of Phosphates Applied to Wheat Grown on Bare Fallow at Werribee—Fifteen Years' Results.

Treatment.	Yield per Acre.	Increase over No Manure Plot.	Value of Increase at 4s. 6d. Bushel.	Cost of Manure per Acre.	Extra return per Acre after deducting Cost of Manure.
	Bushels.	Bushels per acre.	s. d.	s. d.	s. d.
No Manure	6·8	—	—	—	—
Bone Fertilizer 1 cwt. ..	10·2	3·4	13 7	7 6	6 1
Thomas's Phosphate 1 cwt.	11·6	4·8	19 2	5 6	13 8
Super. ½ cwt.	14·3	7·5	30 0	2 6	27 6
Super. 1 cwt. (Check) ..	17·2	10·4	41 7	5 0	36 7
Super. 1½ cwt.	19·4	12·6	50 5	7 6	42 11
Super. 2 cwt.	19·7	12·9	51 7	10 0	41 7

These results clearly demonstrate the superiority of superphosphate for wheat over the other forms of fertilizer used.

With the lightest dressing, there is an extra return of 33s. per acre, and this margin increases with the increase in the rate of application up to 1½ cwt.; there is a further increase with the 2-cwt. dressing, but not sufficient to compensate for the added cost of the manure. Apparently, therefore, under Werribee conditions, the most profitable application is about 1½ cwt. per acre.

Results of Permanent Fertilizer Trials with Wheat Summarized.

The results of these tests appear to justify the following conclusions:—

(1) Superphosphate is the most profitable of all the artificial manures that can be applied to the wheat crop.

(2) The quantity that can be profitably applied per acre is considerably in excess of that usually applied in the wheat areas.

(3) The indirect effect of the heavier dressing in stimulating the subsequent growth of the grass and increasing the stock-carrying capacity of the land is much greater than that of the lighter dressing.

(4) Thomas's phosphate gives less profit than the same quantity of super.

(5) Lime applied either in heavy or light dressings so far has had no profitable influence on yields of wheat at Werribee.

(6) Nitrogenous and potassic manures have not given any profitable increase in the yields.

TABLE III.—EFFECT OF FERTILIZERS ON THE YIELD OF OATS.

Plot No.	Application per Acre.	Average Yield of Grain for Six Years. Bushels per acre.	Average Total Yield of Grain and Straw for Six Years. Cwt. per acre.
1	Super. 1 cwt.	33·6	35·0
2	Farmyard Manure 10 tons	38·1	38·0
3	Farmyard Manure 10 tons + Lime 10 cwt.	37·1	36.5
4	No Manure	18·2	19·1
5	Super. ½ cwt.	35·3	30·4
6	Super. 1½ cwt.	44·4	37·1
7	Super. 2 cwt.	47·2	38·6
8	Super. 1 cwt. + Nitrate of Soda ½ cwt. (with seed)	40·8	35·0
9	Super. 1 cwt. + Nitrate of Soda ½ cwt. (in Spring)	39·8	35·5
10	Super 1 cwt.	38·8	34·1
11	Super. 1 cwt. + Muriate of Potash ½ cwt.	40·8	35·6
12	Super. 1 cwt. + Muriate of Potash ½ cwt. + Nitrate of Soda ½ cwt.	40·6	35·8
13	Bone Fertilizer 1 cwt.	32·2	28·9
14	Thomas's Phosphate 1 cwt.	35·5	30·1
15	Super. ½ cwt. + Thomas's Phosphate ½ cwt.	36·9	33·0
16	Super. 1 cwt. + Lime 5 cwt.	37·8	34·3
17	Super. 1 cwt. + Lime 10 cwt.	36·0	35·7
18	Super. 1 cwt. + Lime 20 cwt.	34·6	32·9
19	Super. 1 cwt.	39·0	33·5
20	No Manure (continuously cropped) ..	13·7	13·3
21	Super. 1 cwt. (continuously cropped)	12·5	13·9

Results of Permanent Fertilizer Trials with Oats Summarized.

Owing to the comparatively short duration of these trials only tentative conclusions can be drawn. These are—

1. That superphosphate is the most profitable fertilizer that can be applied to oats.
2. That about 1½ cwt. per acre appears the most profitable quantity to apply for either hay or grain purposes.

Observations on Flag Smut in the Permanent Manurial Field.

An interesting observation from the work in the wheat sections of this field is that applications of lime apparently favour the development of Flag Smut (*Urocystis tritici*).

During the past few years, Flag Smut has been noticed in increasing quantities in the permanent manurial field. The rotation practised in this field is wheat-fallow-wheat-fallow. In 1927, a satisfactory method of sampling having been developed, counts were made of the percentage infection with the disease on various plots in the field. These counts were repeated in 1928 and 1929.

RESULTS.

Manurial Treatment.	Infection Per Cent. 1927.	Infection Per Cent. 1928.	Infection Per Cent. 1929.
Super, 1 cwt.	0·9	3·7	2·1
Farmyard Manure, 10 tons	6·9	17·0	9·7
Farmyard Manure, 10 tons + Lime, 10 cwt. ..	14·7	28·8	18·5
No Manure	1·9	4·4	2·2
Super., ½ cwt.	..	2·2	2·2
Super., 1½ cwt.	..	2·2	1·5
Super., 2 cwt.	..	2·7	1·0
Super., 1 cwt. + Lime, 5 cwt...	7·6	10·9	10·4
Super., 1 cwt. + Lime, 10 cwt.	13·4	14·4	11·9
Super., 1 cwt. + Lime, 20 cwt.	13·2	11·3	10·0
Super., 1 cwt.	3·2	4·0	3·5

From these results it would seem that the conditions brought about by the application of lime definitely favour the disease; so does the application of the local farm-yard manure. The observations are being continued.

Residual Effect of Fertilizers.

During 1925 and 1926, in order to ascertain the residual effect of previous dressings, the plots were sown without manure. Owing to the dryness of the seasons, the yields were poor. There were, however, notable differences in the results obtained. The yields are shown in the following table:—

TABLE IV.—RESIDUAL EFFECT OF FERTILIZERS ON YIELD OF WHEAT AND OATS (1925-1926).

Application per Acre in previous Years.	Wheat Yield.	Oat Yield.
	Bushels.	Bushels.
Superphosphate, 1 cwt.	5·9	11·6
Farmyard manure, 10 tons	7·4	14·3
Farmyard manure, 10 tons, + lime, 10 cwt.	6·8	11·7
No manure	2·2	5·2
Super., ½ cwt.	2·8	7·4
Super., 1½ cwt.	7·0	11·4
Super., 2 cwt.	8·3	11·5
Super., 1 cwt., + nitrate of soda, ½ cwt. (with seed)	4·5	7·2
Super., 1 cwt., + nitrate of soda, ½ cwt. (in spring)	5·5	8·5
Super., 1 cwt.	4·8	7·8
Super., 1 cwt., + sulph. potash, ½ cwt.	4·1	7·8
Super., 1 cwt., + sulph. potash, ½ cwt., + nitrate soda, ½ cwt. ..	3·1	7·5
Bone fertilizer, 1 cwt.	3·5	8·6
Thomas's phosphate, 1 cwt.	4·0	8·5
Super., ½ cwt., + Thomas's phosphate, ½ cwt.	4 0	7·9
Super., 1 cwt., + lime, 5 cwt.	3·4	6·8
Super., 1 cwt., + lime, 10 cwt.	5·4	8·2
Super., 1 cwt., + lime, 20 cwt.	7·6	9·6
Super., 1 cwt.	4·6	8·4
No manure (cropped continuously)	1·5	7·3
Super., 1 cwt. (cropped continuously)	2·0	6·7

It will be observed that similar differences occur both in wheat and oats. Appreciable residual effect is noticeable in plots to which super., farmyard manure, or lime has been added. Hitherto lime has produced no increase in yield.

Section 3.—Green Manurial and Feeding-off Tests.

OBJECT OF EXPERIMENT.

The soils of this farm, in common with those of the older cultivated wheat lands of the State, have become depleted, by continuous cereal cropping, of much of the organic matter they formerly possessed. This is apparent, not only from the increased difficulty of ploughing the old lands as compared with virgin land, but also from the fact that the virgin land is more productive than the cultivated land. The depletion of the organic content of the soil consequent on repeated cropping with cereals is a serious problem, and experiments are being undertaken in the green manurial and feeding-off tests to determine the most practicable means of restoring the soil to its former level of fertility. The depletion of organic matter can be arrested in three ways—(1) by the direct application of farmyard manure, (2) by the ploughing-in of green crops, and (3) in feeding-off of forage crops and the ploughing-in of the residue.

The application of farmyard manure as a means of achieving this object is generally impracticable, certainly on wheat farms, since the average holding is so large in comparison with the amount of manure produced on the farm. Improvement by means of green manures and by feeding-off to sheep is within the range of economical practice, and the object of the tests in this section is to compare the values of these two methods of soil renovation side by side with the orthodox bare fallow.

OUTLINE OF EXPERIMENT.

In its simplest form this experiment necessitates the use of three plots side by side; one is bare fallow and the other two are sown to some forage such as rape. In the case of these two forage plots, one is fed off to sheep and ultimately the residues and droppings are ploughed in as a late fallow, while the other is not fed off to sheep, but is ploughed under for the future benefit of the soil.

In the next year wheat is sown on all three plots, and subsequently the practice is repeated over a series of years.

If it is desired to test the merits of several forages for use in this way, it is obvious that the number of plots must be correspondingly increased. In the actual experiment at Werribee four forages have been tested, viz., peas, barley, rape, and oats (rye and vetches were formerly grown, but oats were substituted in 1919). These, being sown in duplicate, require eight plots, which, together with two fallow plots, make ten in all. The treatment of each set of forages is identical with that in the simple case outlined above.

In each two-year period the green-cropped plots receive two applications of superphosphate, while the ordinary bare fallow plot receives only one dressing. To check this, an extra bare fallow plot—known as

the manured fallow—is included. During the fallow period this plot receives the same amount of superphosphate dressing as the green crops, as well as the application with the grain crop in the following year.

In order to show the wheat plots and the forages in any one year, the experiment has been duplicated, and a further set of ten plots has been included.

The plots are each one acre in area, and accurate records of the results are obtained. The wheat is harvested and weighed, and in the case of the plots grazed to sheep, the sheep are weighed before entering and after they have finished grazing the plot, and the gain in live weight determined.

It is thus possible, by valuing these returns at current market rates and deducting the extra cost of the new system in each case, to see how the profits compare with the returns from the orthodox wheat after bare fallow.

For the purpose of comparing the effect of ploughing in and feeding off of green crops on a following oat crop, the wheat plots were in 1921 reduced to half an acre each, the other half of each plot being sown to oats.

Results over a number of years are now available, and there are indications that they will throw considerable light on our current agricultural practices.

In order to ascertain, if possible, the residual effect of green manuring and feeding off, the green crops were not grown in 1924 and 1925; instead the ground was fallowed, and the yield of the succeeding grain crops are consequently not included in Tables I. and II.

TABLE I.—YIELDS OBTAINED FROM WHEAT PLOTS GROWN AFTER BARE FALLOW IN ROTATION WITH FORAGES FED OFF TO SHEEP, AND WITH SIMILAR FORAGES PLOUGHED UNDER (AVERAGE OF FOURTEEN YEARS).

Rotation.	Average Yield per Acre for Fourteen Years, 1914–1929.
	Bushels.
Wheat after Rape, fed off	17·3
Wheat after Barley, fed off	9·5
Wheat after Peas, fed off	17·3
Wheat after Oats, fed off (Rye prior to 1919) ..	15·0*
Wheat after Bare Fallow	19·6
Wheat after Rape, ploughed in	18·3
Wheat after Barley, ploughed in	10·6
Wheat after Peas, ploughed in	19·7
Wheat after Oats, ploughed in (Rye prior to 1919)	16·3*
Wheat after Bare Fallow, manured	20·0

* For the first five years of the test Rye and Vetches were sown as a green crop on these plots, Algerian Oats being substituted in 1919.

NOTE.—As soon as the forage crops are fed off, the plots are ploughed, thus the wheat is sown on late "fallow.

The very low yield of wheat when preceded by barley has been shown to be largely due to the presence of "Take-all" in the plot, and, as barley acts as a host plant for that fungus, the disease has been carried on from year to year with increasingly disastrous results. Rye acts in the same way, and it was for this reason that in 1919 oats was substituted for the rye and vetches mixture. The indications at present are that the oats is maintaining its reputation for resistance to "Take-all," and is assisting to starve out the disease. In addition, oats has given very good grazing results on the fed-off plot.

TABLE II.—YIELDS OBTAINED FROM ALGERIAN OATS GROWN AFTER BARE FALLOW IN ROTATION WITH FORAGES FED OFF TO SHEEP, AND WITH THE SAME FORAGES PLOUGHED UNDER (AVERAGE OF SEVEN YEARS).

Rotation.	Algerian Oats—Average Results for Seven Years, 1921–1929.	
	Grain. Bushels per Acre.	Combined Weight of Grain and Straw. Cwt. per Acre.
Algerian Oats after Rape, **fed off**	35·0	38·7
Algerian Oats after Barley **fed off**	40·7	40·9
Algerian Oats after Peas, **fed off**	38·9	44·5
Algerian Oats after Oats, **fed off**	39·5	40·0
Algerian Oats after Bare Fallow	44·6	48·6
Algerian Oats after Rape, **ploughed in**	37·4	45·4
Algerian Oats after Barley, **ploughed in**	40·7	41·6
Algerian Oats after Peas, **ploughed in**	45·1	47·8
Algerian Oats after Oats, **ploughed in**	39·2	38·4
Agerian Oats after Bare Fallow, **manured** ..	47·8	53·0

NOTE.—As soon as the forage crops are fed off, the plots are ploughed; the oats are, therefore, sown after "late" fallow.

So far as they go, the experiments show that under local conditions no immediate benefit to the succeeding grain crop has been derived by

the substitution of the relatively costly old-world practice of green manuring for one in which the green stuff is economically grazed by sheep.

In order to test the value of the respective systems of farming, however, it is not sufficient to take into consideration the yields from the grain crops alone; those from the green crops must also be included. In Table III. below, the returns are given of the wheat crop following fallow, compared with the combined returns of the wheat and green crops in the various rotations. Table IV. gives similar returns in connexion with oats.

The total gross returns for an average two-year period are set out, together with the increased cost in connexion with the cultivation of the green crop. By deducting this cost, together with the return from grain after bare fallow, from the total gross returns, the net profit for each acre of fallow sown to greenstuff is obtained.

TABLE III.—SHOWING AVERAGE NET RETURNS FROM WHEAT ROTATION FOR EACH ACRE OF FALLOW REPLACED BY GREENSTUFF (FOURTEEN YEARS—1914-1929).

Rotation.	Value of Wheat Crop at 4s. per bushel. Per acre.	Value of Wool and Live Weight Increase. Per acre.	Gross Return for each two-year period. Per acre.	Increased Cost of raising Green Crop and Wheat over Fallow and Wheat. Per acre.	Gross Return in Two Years after deducting Extra Cost due to Green Cropping. Per acre.	Extra Return for each acre of Bare Fallow replaced by Greenstuff for each two-year period. Per acre.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat after Rape, **fed off**	3 9 4	1 12 10	5 2 2	1 4 10	3 17 4	**1 0** loss
Wheat after Barley, **fed off**	1 18 0	3 1 4	4 19 4	1 7 4	3 12 0	**6 4** loss
Wheat after Peas, **fed off**	3 9 4	1 10 10	5 0 2	2 4 11	2 15 3	**1 3 1** loss
Wheat after Oats, **fed off**	3 0 0	3 8 6	6 8 6	1 6 7	5 1 11	**1 3 7** gain
Wheat after Bare Fallow	3 18 4	..	3 18 4	..	3 18 4	..
Wheat after Rape, **ploughed in**	3 13 4	..	3 13 4	1 6 8	2 6 8	**1 11 8** loss
Wheat after Barley, **ploughed in**	2 2 4	..	2 2 4	1 8 11	0 13 5	**3 4 11** loss
Wheat after Peas, **ploughed in**	3 18 8	..	3 18 8	2 6 7	1 12 1	**2 6 3** loss
Wheat after Oats, **ploughed in**	3 5 0	..	3 5 0	1 8 10	1 16 2	**2 2 2** loss

NOTE—In calculating this table, wheat has been valued at 4s. per bushel, and each pound actual increase in live weight of sheep at 3d. An allowance has also been made on the basis of 7s. 8d. per year, i.e., ¼d. per day, for increased value in wool of the sheep used.

Table IV.—Showing Average Net Returns from Oat Rotation for each Acre of Fallow Replaced by Greenstuff (Seven Years—1921-1929).

Rotation.	Value of Oat Crop at 3s. 6d. per bushel. Per acre.	Value of Wool and Live Weight Increase on each Plot. Per acre.	Gross Return for each two-year period. Per acre.	Increased Cost of raising Green Crop and Oats over Fallow and Oats. Per acre.	Gross Returns in Two Years after deducting Extra Cost due to Green Cropping. Per acre.	Extra Return for each acre of Bare Fallow replaced by Greenstuff for each two-year period. Per acre.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Algerian Oats after Rape, **fed off** ..	6 2 6	0 19 8	7 2 2	1 6 10	5 15 4	2 0 9 loss
Algerian Oats after Barley, **fed off**	7 2 5	2 10 1	9 12 6	1 9 4	8 3 2	0 7 1 gain
Algerian Oats after Peas, **fed off**	6 16 2	1 16 4	8 12 6	2 6 5	6 6 1	1 10 0 loss
Algerian Oats after Oats, **fed off**	6 18 3	3 1 10	10 0 1	1 8 4	8 11 9	0 15 8 gain
Algerian Oats after Bare Fallow	7 16 1	..	7 16 1	..	7 16 1	
Algerian Oats after Rape, **ploughed in**	6 10 11	..	6 10 11	1 8 8	5 2 3	2 13 10 loss
Algerian Oats after Barley, **ploughed in**	7 2 5	..	7 2 5	1 10 11	5 11 6	2 4 7 loss
Algerian Oats after Peas, **ploughed in**	7 17 10	..	7 17 10	2 8 0	5 9 10	2 6 3 loss
Algerian Oats after Oats, **ploughed in**	6 17 2	..	6 17 2	1 10 9	5 6 5	2 9 8 loss

Note.—In calculating this table, oats have been valued at 3s. 6d. per bushel, and each pound actual increase in live weight of sheep at 3d. An allowance has also been made on the basis of 7s. 8d. per year, i.e., ¼d. per day, for increased value in wool of the sheep used.

In these tests it will be seen that oats as a fed-off crop has given very satisfactory results; followed either by wheat or oats for grain, the returns show a substantial increase over the bare fallow method. In order to obtain good results, however, it is probably essential that the crop residues should be ploughed-in sufficiently early to give the land a period of at least six months in fallow. This ensures that the succeeding grain crop will be sown under at least reasonably favorable conditions.

The reason for the very poor showing of rape in the above tables is that, in recent years, it has been so severely attacked by pea mites when in the seedling stage that the crop rarely appeared very much above-ground. If this drawback could be removed, it is certain that rape would occupy a much more favorable position in the tests, although, even so, the somewhat unsuitable soil and the frequent periods of dry weather experienced at Werribee would militate against the complete success of the crop.

Oats has given the best grazing returns since the crop was introduced in 1919. Table V. below affords a comparison of the grazing value of the forages grown since that year.

TABLE V.—SHOWING COMPARATIVE GRAZING VALUES OF VARIOUS FORAGES OVER PERIOD 1919-1929 (RESULTS PER ACRE).

Crop.	Live Weight Increase. Lb. per Acre.	Sheep Days. Per Acre.	Values of Live Weight Increase. Per Acre.	Values of Wool Produced. Per Acre.	Total Feeding Values. Per Acre.
			£ s. d.	£ s. d.	£ s. d.
Rape	65	165	0 16 3	0 3 5	0 19 8
Barley	166	413	2 1 6	0 8 7	2 10 1
Peas	116	354	1 9 0	0 7 4	1 16 4
Oats	204	522	2 11 0	0 10 10	3 1 10

NOTE.—In this table 3d. has been allowed for each pound actual increase in live weight. An allowance for each sheep sustained for one day has also been made on the basis of 7s. 8d. per year, *i.e.*, one farthing per day for increased value of wool of the sheep used.

The term "sheep days" refers to the number of days for which the crop would maintain one sheep, or the number of sheep which the crop would maintain for one day. Thus the figures are obtained by multiplying the number of sheep by the number of days they were on the plot.

In order to ascertain whether the cumulative effect of the green crops on the soil was being masked by the green crop depleting the soil of moisture and thus limiting the growth of wheat, the two series of plots in this field were left in fallow during 1924 and 1925, instead of being sown to green crops as usual. The yields of the wheat grown in the following years, together with the average yields for the preceding eleven years, are contrasted in the table below.

TABLE VI.—AVERAGE YIELDS OF WHEAT AFTER GREEN MANURE, FOR ELEVEN YEARS (1914-24), COMPARED WITH THOSE OBTAINED ON THE SAME LAND FROM WHEAT SOWN AFTER FALLOW (GREEN CROPS OMITTED) IN THE TWO FOLLOWING YEARS (1925-1926).

Rotation.	Average Yields per Acre for Eleven Years, 1914–24.	Average Yield, 1925-26, Green Crop Omitted.
	Bushels.	Bushels.
Wheat after Rape, fed off	18·2	20·7
Wheat after Barley, fed off	8·9	19.2
Wheat after Peas, fed off	18·4	21·4
Wheat after Oats, fed off	15·3	24·0
Wheat after Fallow	19·0	22·1
Wheat after Rape, ploughed in	18·0	19·4
Wheat after Barley, ploughed in	9·4	15·0
Wheat after Peas, ploughed in	19·7	19·0
Wheat after Oats, ploughed in ..	15·6	23·8
Wheat after Fallow (manured)	20·2	21·1

The results, so far as they go, appear to suggest that, in the case of barley and oats, there was a cumulative effect on the soil which had been masked in previous years. However, the possibility has to be considered that at least part of the increased wheat yield obtained may have been due to a reduction in the amount of "Take-all" present in the wheat—a result attributable to the absence of the usual forage host. Later, the test will be repeated, and these conclusions probed under controlled conditions.

Results Summarized.

The results appear to show that under Werribee conditions suitable forage crops may with profit be substituted for the usual bare fallow preceding a grain crop, provided that the land is fallowed immediately the forage crop has been disposed of.

Oats seem to have proved the best all-round forage crop for this purpose.

The results so far indicate that to combat "Take-all" oats is a more suitable cereal to precede wheat than either barley or rye.

The returns from the grazing value of rape undoubtedly would have been greater had it not been for the damage caused by the pea-mite pest during the past few years.

The figures demonstrate that for growing wheat and oats for grain the practice of ploughing in green crops is unprofitable.

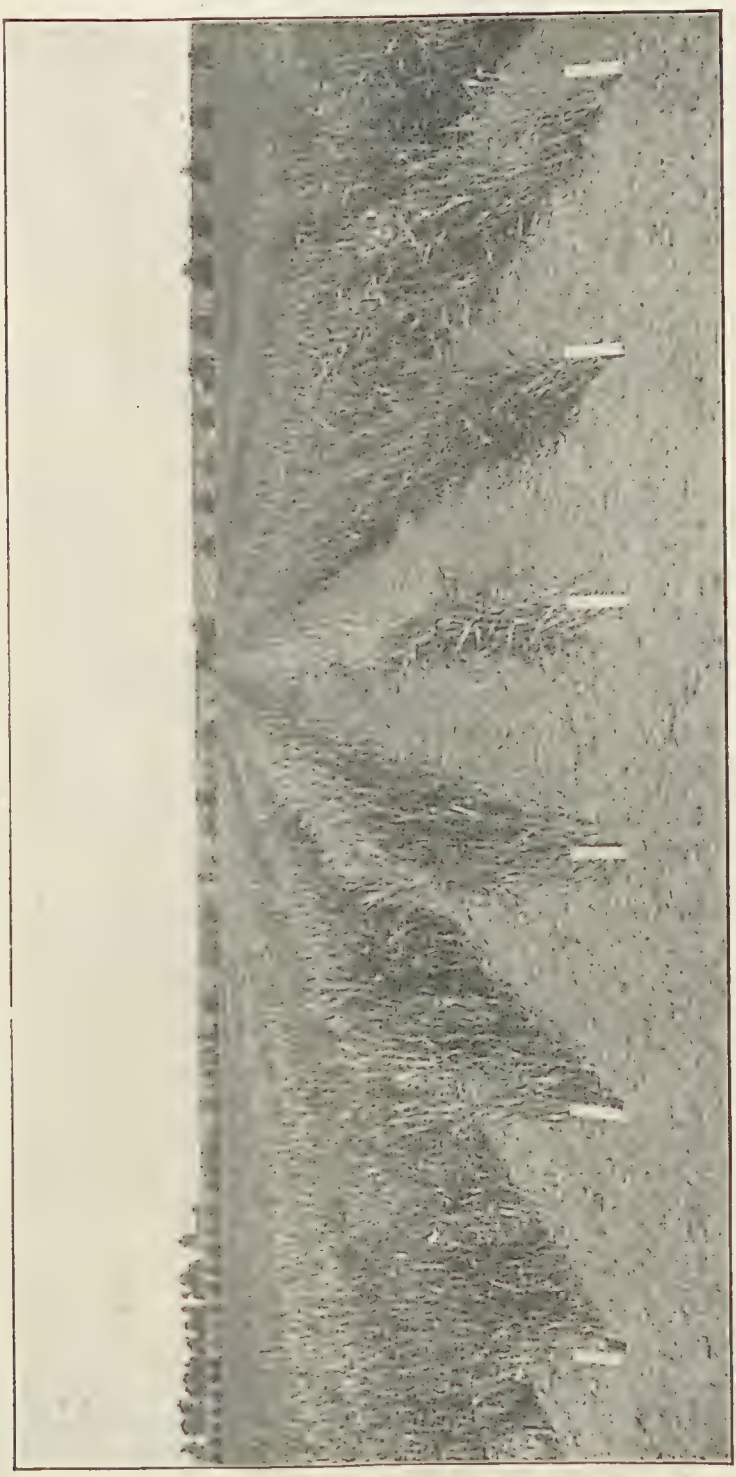
Harvesting New Cross-bred Wheats in "Long Row" Section.

Section 4.—Stud Cereals and Cross-bred Plots.

(Field No. 10A, S.E.)

One of the primary aims of the farm since its inception has been to produce, by cross-breeding and selection, new varieties of wheat, oats, and barleys. The stud cereals and crossbred plots occupy an area of 10 acres, and comprise a series of rows and plots devoted to stud wheats, barleys, and oats, and new crossbreds in the early stages of development. Several thousand new crossbred cereals are undergoing competitive trials in this section. These are in all stages of development from the first to the sixth generation.

There is also a complete collection of standard Australian types. These form the stud plots for improvement by systematic selection and cross breeding.



View of New Fixed Cross-bred Wheats in Nursery Rows.

A large number of selected cereals has been obtained, by exchange, from Departments of Agriculture and Experiment Stations in England, the United States, Canada, New Zealand, Italy, Mesopotamia, India, Russia, France, Japan, and Peru, and these have been sown in small trial plots. It is anticipated that some of these, after acclimatization, will be of value for crossing purposes, as some of them possess characteristics, such as early maturity, milling quality, drought and disease resistance, which have been of considerable value as a means of improving local varieties.

Section 5.—"Long Rows," "Selection," "Variety," "Seed" Plots of Wheat, and "Replicated" Variety Plots.

(Far Austral and North Railway Fields.)

In order to clearly define what the terms at the head of this section stand for, the various stages comprising the wheat improvement work, together with some definite results achieved to date, are briefly summarized as follows:—

1. Nursery or stud row plots of standard, introduced and cross-bred cereals (Section 4), approximately 3,265 plots.
2. "Long Rows" of fixed cross-bred and other cereals which have shown promise of usefulness in the above section and are now growing in rows 5 chains long .. .. 496 plots.
3. "Selection Plots" (1/40 acre), including the best standard varieties and new cross-breds which continued to show merit in the "Long Row" section, and have been promoted to this section .. 139 plots.
4. "Variety Plots" (¼ acre), comprising standard varieties and new cross-breds which have given the best results in selection plots, and are considered worthy of a comprehensive trial in the various Departmental tests in the wheat-growing districts of the State .. .. .. 62 plots.
5. Replicated variety plots .. .. .. 100 plots.
6. "Seed Plots" (2 acres), the standard varieties and cross-breds which have given such good results in the above tests as to warrant distribution. These plots provide seed for the bulk areas .. .. 21 plots.
7. Bulk areas for production of seed for sale to farmers .. .. 8 plots.

With the exception of the first and second generation plots, in all these sections the new wheats are grown in competition with a prolific standard variety such as Free Gallipoli. Thus the merits of each new wheat are thoroughly tested, the figures indicating the drastic culling which takes place at each stage.

Wheat Breeding Activities.

The main objective has been the production of prolific and drought resistant wheats, suitable for the different districts of the State, and in this direction considerable success has been achieved. This year 2,680,393 acres, or 56 per cent. of the wheat area in Victoria was sown with varieties which originated at the State Research Farm, Werribee. The rapidity with which these wheats have displaced the older varieties is indicated by the following table:—

Distribution of Werribee Bred Wheats.

Year.	Acreage Sown in Victoria.	Percentage Total Area.
	acres.	%
1925	66,000	2
1926	195,000	6
1927	507,000	16
1928	1,000,000	25
1929	1,480,000	41
1930	2,680,393	56

The farm is particularly suited to the production of drought-resistant varieties, and the Departmental plots, scattered throughout the wheat belt, are especially valuable in indicating the suitability or otherwise of the new crossbreds to various districts.

Free Gallipoli raised at Werribee is now the most extensively grown variety, and this year 1,654,560 acres have been sown with this wheat in Victoria, as compared with 667,669 acres of Federation, which for more than a decade held first place. Free Gallipoli is a mid-season variety, and has proved its adaptability to a wide range of conditions, a fact which is demonstrated by the following table showing the areas sown with this wheat in the various districts of the State:—

Distribution of Free Gallipoli, 1930.

District.	Acreage Sown with Free Gallipoli.	Percentage of Total Area Sown.	Order of Popularity.
	acres.	%	
Mallee	747,912	31	1st
Wimmera	509,283	43	1st
Northern	289,217	33	1st
North-Eastern	21,238	42	1st
Gippsland	2,074	7	2nd
Central	15,457	21	2nd
North Central	10,488	29	2nd
Western	58,891	49	1st
State	1,654,560	35	1st

Free Gallipoli originated as a single plant selection from the variety Gallipoli in 1917. Having proved its superiority in the departmental plots throughout the State, it was distributed to farmers for the first

time in 1923. Two years later 21,311 acres of the State were sown with Free Gallipoli, and within six years it had deposed Federation, which up till 1929 was the most extensively grown variety in Victoria. The remarkable rise to popularity of Free Gallipoli is demonstrated in the following table:—

Acreage Sown in Victoria.

Year.	Federation.		Free Gallipoli.	
	Area Sown.	Per cent. Total Area.	Area Sown.	Per cent. Total Area.
	acres.	%	acres.	%
1925	1,255,300	43·0	21,311	·7
1926	1,362,640	44·7	40,510	1·3
1927	1,222,848	38·4	174,099	5·4
1928	1,345,370	33·4	425,061	10·5
1929	715,238	19·8	801,964	22·2
1930	667,669	13·9	1,654,560	35·0

Ranee, another variety bred at the Research Farm, is the third most popular wheat in the State, and this year 629,432 acres have been sown. It is an early mid-season variety, particularly suited to the drier areas of the wheat belt; this season 378,636 acres of Ranee have been sown in the Mallee.

A later selection of this variety has outyielded the original form of 3.9 bushels per acre over the past six years at Werribee. Seed of this selection (Ranee 4 II) is available for distribution to growers this year.

Sepoy, another Werribee production, and the fourth most popular wheat, is rapidly winning favour, and this year 271,473 acres have been sown in Victoria. It is a late-maturing variety which yields exceptionally well in the Mallee.

Rajah, an early-maturing type, was also bred at Werribee. This variety is very drought-resistant, and is particularly suited to the drier areas of the wheat belt. The original strain of Rajah had a tendency to shake in high winds, but, by careful selection over a period of years, this fault has been almost entirely eliminated; the new strain also gives consistently higher yields.

Ghurka, a short strawed, mid-season, drought-resistant variety is also proving itself as a type suited to wide range of conditions. This year some 29,000 acres have been sown in Victoria.

A sixth variety, Mogul, which is a selection from Rajah, is also finding a place for itself in the Central and North-Central districts of the State, where some 2,858 acres have been sown with it this year. Over the past six years at Werribee this variety has outyielded all others by 2 bushels per acre.

The yields of these crossbreds, together with several of the standard varieties, are given in the table below, the yields being the average for both Variety and Selection Plots over a period of six years.

Wheat Variety and Selection Plots (Average Results for Six Years, 1924-1929).

Variety or Pedigree.	Yield.
	bushels per acre.
Mogul	26·9
Federation x Major W 6914 E 3–3	25·0
Ranee x Rajah W 5023 E 4	24·9
Free Gallipoli	24·8
Currawa x Major x Gallipoli W 5319 F 3–3	24·1
Rajah	24·0
Ranee	23·6
Sepoy	22·9
Golden Grain x Bobs W 7815 D 2–1–3	22·9
Ghurka	22·4
Major	22·4
Federation	21·1
Yandilla King	19·4
Warden	17·8

These results may be taken as indicating the suitability or otherwise of the varieties for the Werribee and surrounding district.

Efforts are also being concentrated on the production of new prolific varieties which are disease-resistant. Special attention is being devoted to Flag Smut (*Urocystis tritici*), which is responsible for considerable losses to the wheat-grower each year.

(B) Hay Wheats.

Several of the new crossbred wheats with a strong habit of growth have been tested against Warden in order to determine whether a better hay wheat than that variety could be evolved. So far, the crossbred, Golden Grain x Bobs, is the most promising, and it is considerably earlier than any of the other hay wheats tested.

Wheaten Hay Tests (Average Results for Seven Years, 1923-1929).

Variety or Pedigree.	Yield.	
	Grain.	Hay.
	bushels per acre.	cwt. per acre.
Golden Grain x Bobs W 7815 D 2–1–3	26·8	44·0
Warden x Firbank W 5904 E 2	19·6	43·1
Warden x Firbank x King's Early W 5893 E 1	20·8	42·3
Warden	20·0	41·1
Yandilla King	22·5	38·2

Replicated Variety Trials.

In the testing of the new crossbred productions, it is usually possible, from a study of their characteristics, to suggest a similar standard variety with which they will compete when distributed, and which they must outyield for commercial success. This standard variety is used as a control in a system of replicated plots with the new production concerned, and success over three years in this final test at

Werribee and in country centres is necessary before distribution is considered.

The following table gives the latest results from the Werribee Replication Trials:—

Replicated Trials, Werribee, 1927-1929.

Variety.	Yield.	Control.	Yield.	Increase or Decrease on Control	Remarks.
	b.p.a.				
3 *Years' Results*—					
Free Gallipoli ..	19·2	Federation ..	16·7	+ 2·5	Confirmatory test only
Cu. x Maj. x Glp.	18·2	F.G. ..	19.8	— 1·6	Failed
Rance 4H ..	23·4	Rance ..	19.8	+ 3·6	Distributed 1930
Ind. F. x Fed. ..	20·2	„ ..	19.0	+ 1·2	Discarded in favour of Rance 4H
2 *Years' Results*—					
Mogul ..	23·1	F.G. ..	19·1	+ 4·0	Confirmatory test only
Rajah 2281 2 ..	23·8	Rajah 2281	23·5	+ 0·3	Result not significant
Sepoy 324J ..	19·8	Sepoy ..	19·5	+ 0·3	„ „
Hay Varieties.	cwt.p.a.		cwt.p.a.	cwt.p.a.	
2 *Years' Results*—					
Golden Grain x Bobs	38·2	Warden ..	35·5	+ 2·7	O.K.

Section 6.—Barley and Oat Variety Plots.

(Far Australal.)

This section contains 17 barley and 30 oat variety plots, each one-sixteenth acre in area. Until the last few years these cereals have not received the attention in regard to maintaining their prolificacy by seed selection and the production of new varieties that has been accorded to wheat. Work of a similar nature to that carried out with wheat is, however, now in progress, and the results, more especially with oats, appear to suggest that much is to be hoped for from the introduction of new standard varieties and the production of cross-breds.

Barley Variety Trials.

Table I.—Average Yields for Seven Years (1923-1929).

No.	Variety or Pedigree.		Yield.
			Bush./Acre.
1.	Feed Types	Roseworthy Oregon x Californian Feed W 6011 D 5	32·2
2.		Cape	31·5
3.	Malting Types	Barrett's Selection Pryor	29·8
4.		Pryor x Pryor W 5029 E 5	29.4
5.		Pryor x Pryor W 5030 E	29·2
6.		Pryor	28·8

Attention has been focussed on the production of a drought-resistant, high-yielding type of oats, and success has been achieved in the variety Palestine. This variety arose as a selection from a sample of oats gathered in Palestine during the War by Dr. T. Cherry. It is very short in the straw and of very early maturity, and has proved itself suitable as an early grain oat over a wide range of conditions.

Thrashing Produce from Barley Variety Plots.

OAT VARIETY TRIALS (GRAIN).

(Average yields for five years, 1925-1929.)

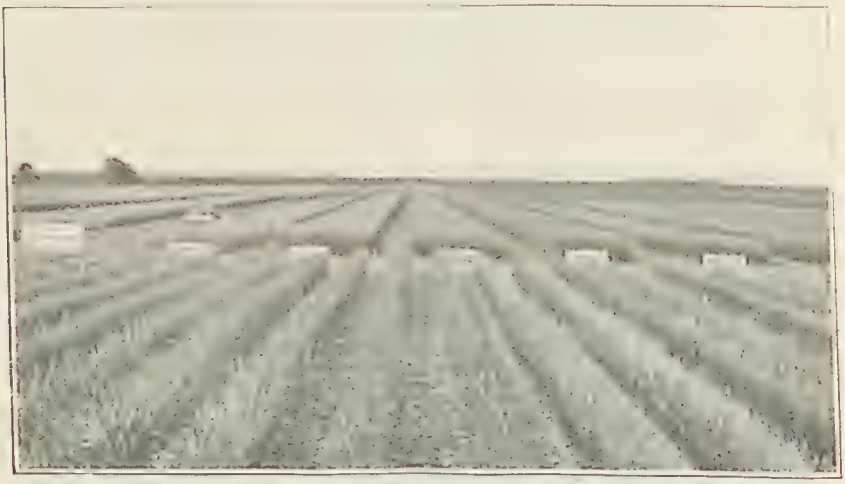
Variety or Pedigree.	*Yield. Bushels per acre.*
Wild Oat X Ruakura W 5003 16-1-3	41.6
Sunrise Selection	38.3
Lachlan	37.4
Palestine	37.2
Richland	34.6
Mortgage Lifter	34.0
Algerian	33.9
Burt's Early	27.5

Initiated in 1926, variety tests with oats for hay have been conducted over the past four years. The results are included in the following table:—

OATEN HAY TESTS.

(Average yields for four years, 1926-1929.)

Variety or Pedigree.	*Yield. Cwts. per acre.*
Sunrise Selection	42.8
Wild Oat X Ruakura W 5003 16-1-3	42.1
Algerian	41.7
Lachlan	39.8
Burt's Early	32.0
Palestine	31.4



Oat Variety and "Long Row" Plots, State Research Farm, Werribee.

Harvest Time, Stud Cereal Field, State Research Farm, Werribee.

Section 7.—Miscellaneous Cereal Tests.

1. Rate of Seeding and Time of Sowing Trials.

(NORTH BLUEGUM FIELD).

The object of these trials is to determine the influence of the rate of seeding and time of sowing on yields of wheat and oats.

The tests with wheat comprise twelve plots. The same variety of wheat is used throughout, but there are six different rates of seeding. One set of six plots is sown early and a duplicate set about two months later.

The average results for the twelve years, 1915-1926, are given in the table below:—

TABLE I.—RATE OF SEEDING AND TIME OF SOWING TESTS WITH WHEAT. —AVERAGE RESULTS FOR TWELVE YEARS (1915-1926).

Seed Sown per Acre.	Yields in Bushels per Acre.		Difference in Favour of Early Sowing. Bushels per Acre.
	Early Sown Plots.	Late Sown Plots.	
lb.			
20	15·6	11·5	4·1
30	17·9	13·1	4·8
45	19·4	14·8	4·6
60	19·7	16·2	3·5
80	21·2	17·8	3·4
120	21·4	18·0	3·4
Average for all weights	19·2	15·2	4·0

During the last two years a different range of rates of seeding, representing more nearly those in practical use, have been observed. These rates, and the results obtained, are as follow:—

TABLE II.—RATE OF SEEDING TESTS.—RESULTS FOR YEARS 1927-1929.

Seed Sown per Acre.	Early Sown Plots.	Late Sown Plots.	Difference in Favour of Early Sowing.
lb.	bus.	bus.	bus.
45	16·9	9·8	7·1
60	18·2	10·5	7·7
75	17·8	10·8	7·0
90	17·4	10·9	6·5
105	17·5	10·2	7·3
120	17·4	10·6	6·8

Wheat Pickling Tests.

(North Sunrise Field.)

The plots are mainly confined to determining the effect of the pickle on the germination, growth, and subsequent yield obtained from the seed.

This Yield Trial section consists of 18 plots, each approximately 1-10th acre in area. There are six plots of each of the following treatments:—

Bluestone 1¼ per cent., soaked for 3 minutes.
Formalin 1-450, soaked for 3 minutes.
Dry Copper Powder, 2 oz. per bushel.

The seed treated with dry copper powder results in a better germination and early growth than does the wet pickled seed, and usually produces a small increase in yield. All three pickles have given effective control for ordinary smut infection.

Besides these twelve plots there are six others on which a similar test with oats is being carried out. The results are shown in the following table:—

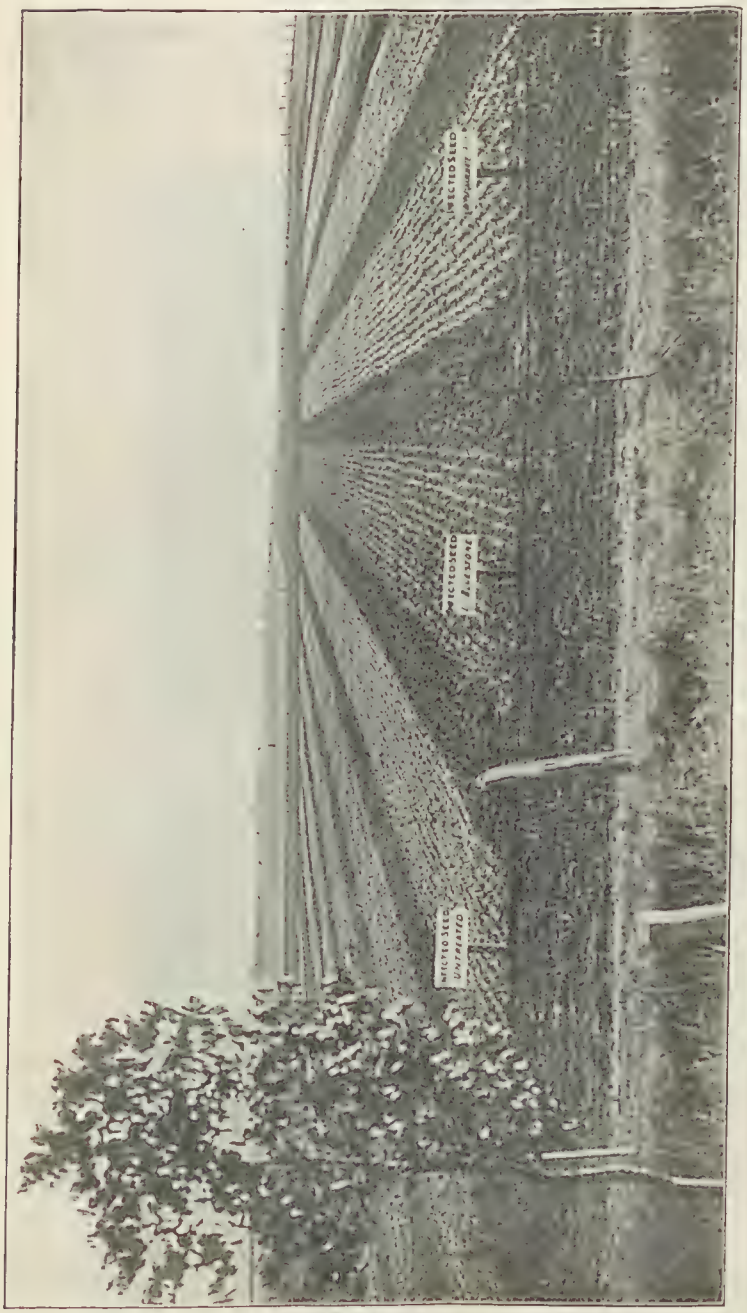
Table II.—Rate of Seeding and Time of Sowing Tests with Oats. —Average Results for Twelve Years.

Seed Sown per Acre.	Yields in Bushels per Acre.		Difference in Favour of Early Sowing.
	Early Sown Plots.	Late Sown Plots.	
lb.			
50	34·2	22·9	11·3
70	37·8	23·2	14·6
90	36·7	25·2	11·5
Averages ..	36·2	23·8	12·4

These results indicate that, in this district at least, early sowing gives substantially increased yields over late sowing, especially in regard to oats.

It would seem also that, for both crops, about 80 lb. per acre is the most profitable seeding, the rate to be slightly increased should circumstances necessitate late sowing.

The time of sowing tests with different varieties have been discontinued. Over a number of years, the results from these plots indicated that late varieties, such as Marshall's No. 3 and Yandilla King, require a long-growing period, and should, therefore, be sown early; and that early (or quick-maturing) varieties, such as King's Early and Gluyas, give better results when sown reasonably late.



Infected seed.
Untreated.

Infected seed.
1½ % Bluestone.

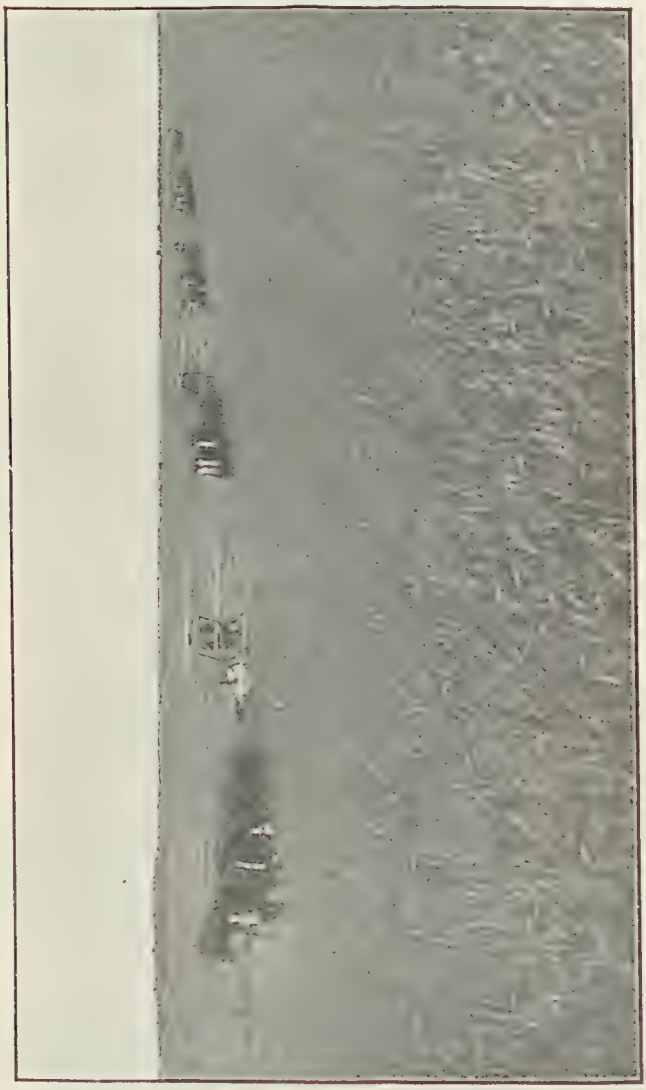
Infected seed.
Copper Carbonate, 2 oz. per bushel.

Experiments in Treating Infected Seed.

3. Treatment for Loose Smut.

For many years the prevalence of loose smut ("blow smut") in wheat has given farmers considerable concern.

In 1927 apparatus was installed at Werribee for the purpose of testing the efficiency of a treatment devised by Dr. Tapke in America.



Harvesting Shandy Hay at Werribee.

This method, which, like Jensen's method, involves the use of penetrating hot water, however, merely requires a single immersion.

As the table given below indicates, immersion for 1 hour 40 minutes in water held at 120 deg. F. has given fairly satisfactory results in

controlling the disease. The table below gives, in a precise form, the results obtained to date:—

Treatment.	Total Smutty Heads per 1/20 Acre.			Average.
	1927.	1928.	1929.	
Untreated	1,603	585	75	754
40 minutes, at 120° F.	..	245	..	..
1 hour, at 120° F.	64	155	37	85
1 hour 20 minutes, at 120° F. ..	27	56	0	27
1 hour 40 minutes, at 120° F. ..	3	2	1	2
2 hours, at 120° F.	1	..	..	..

As the preliminary tests have proved satisfactory, steps have been taken to treat the whole of the varieties grown in the experimental fields for multiplication and use in sowing the bulk fields. By eliminating infection in this way, it is hoped shortly that seed wheat free from all traces of infection will be available for sale.

Section 8.—Bulk Seed for Distribution.

The bulk cereal crops for grain comprise approximately 212 acres of wheat, 60 acres of barley, and 50 acres of oats of the following varieties:—

Wheat—

Free Gallipoli, Rajah, Ranee, Sepoy, Ghurka, Mogul, Major and Warden.

Barley—

Pryor.

Oats—

Sunrise Seln., Algerian and Palestine.

The grain obtained from these areas will be available for distribution among farmers as graded seed. Special precautions are taken to maintain its purity and trueness to type. The following quantities of graded seed were distributed from the State Research Farm for sowing this year:—

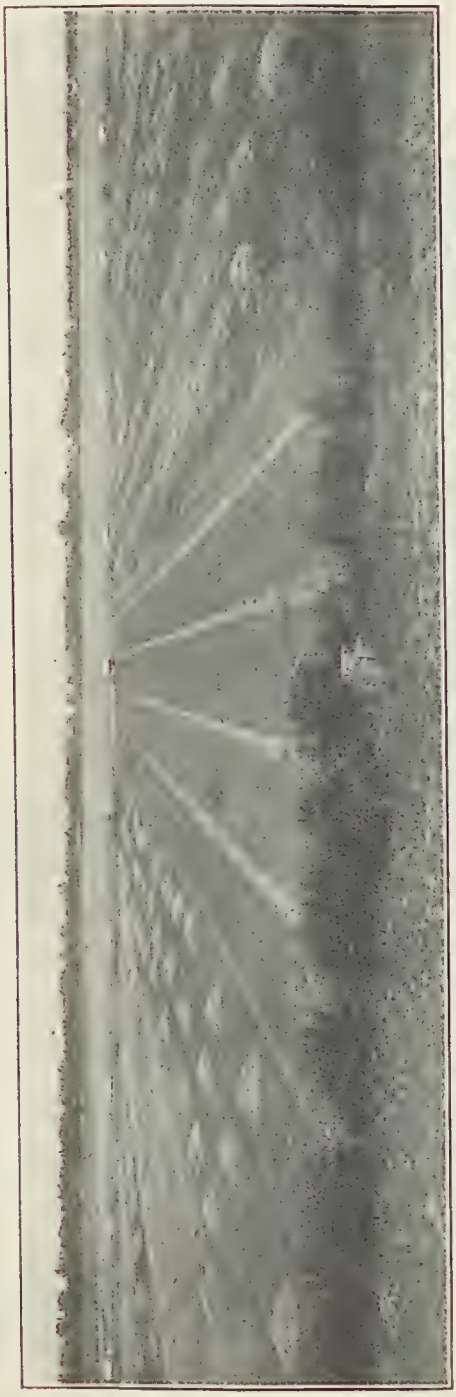
Wheat	1,317	bushels
Oats	1,774	„
Barley	146	„
Total	3,237	„

IRRIGATION INVESTIGATIONS.

Three 10-acre fields are devoted to irrigation experiments. The plots in both were laid down in September, 1925—

(1) Field No. 8, S.E.—Lucerne tests.
(2) Field No. 2, S.W.—Pasture tests.
(3) Field No. 12A.—Grazing tests.

In the lucerne field the lessons already learned are being demonstrated, and new tests suggested by the results of the last experiments, which finished in 1924, are being undertaken.



View of Rate and Frequency of Watering Tests at State Research Farm, showing contrast between Irrigated and Non-Irrigated Plots.

The Plots in the centre received no Artificial Moisture.

The objective is the determination of the best methods of watering, cutting, manuring, and renovation of lucerne. A number of imported strains of lucerne are being subjected to trial by comparison with Hunter River.

The irrigated pasture tests are on the same lines. The influence of varied irrigation and manurial treatment on the productivity and character of pastures is being studied.

The results of the lucerne tests which were conducted in Field No. 2, S.W. (the present pasture field) from 1919 to 1924 are presented below. The results available to date from the new field are also shown:—

This field was divided into six sections—

(*a*) Rate and frequency of watering.
(*b*) Spacing of rows.
(*c*) Time of cutting tests.
(*d*) Renovation tests.
(*e*) Variety trials.
(*f*) Fertilizer tests.

(*a*) Rate and Frequency of Watering.

The object of this test is to determine the effect on the yield of varying quantities of water with varying rates and times of application. The section contained ten plots.

The results obtained for two seasons in the earlier series are set out in the following table:—

Table I.—Rate and Frequency of Watering, 1921-22 and 1922-23.

Plot.	Total Water Applied per annum.	Number of Applications.	Yields of Hay per Acre (15 per cent. Moisture)		
			Season 1921-22 Rainfall 19·26".	Season 1922-23. Rainfall 16·6".	Average.
	inches.		cwt.	cwt.	cwt.
1	18	6	121·6	118·3	120·0
2	18	3	116·3	105·8	111·0
3	24	6	142·1	141·6	141·8
4	24	4	137·3	131·4	134·4
5	24	8	130·7	127·8	129·3
6	Nil	..	35·8	23·6	29·7
7	30	5	150·3	147·0	148·6
8	30	6	152·2	155·1	153·6
9	36	6	162·4	143·8	153·1
10	48	8	171·1	159·9	165·5

There was an increased production as the amount of irrigation water applied was increased, but it was not proportional to the added amounts of water.

The first 18 inches of water in addition to rainfall produced an increased yield of 90.3 cwt., the second 18 inches only 33.1 cwt.; 24 inches of water increased the yield by 112.1 cwt.; an additional 24 inches of water gave a further yield of only 23.7 cwt.

There is an increased water cost of hay from the different bays, as heavier yields are induced by increased irrigation. Correlatively, the yield per acre-inch of water shows a successively diminishing return from the lighter to the heavier waterings.

It must be remembered that the irrigation water is supplemental to the rainfall, and the efficiency of the rainfall depends not only on the quantity which falls, but the time at which it falls.

During the four seasons 18 inches of water has been insufficient for full development of the crops, and although when applied in six lots of three inches a fairly uniform growth was maintained, the lucerne generally bore the dark-green appearance which indicates lack of sufficient moisture.

It may be stated that at least 24 inches of water in addition to the average rainfall is needed to maintain favorable moisture conditions for lucerne, but even that amount does not set a limit to profitable irrigation. Moreover, the efficacy of 24 inches of water varies according to the manner in which it is applied.

Six applications of four inches produced a bigger yield than four six-inch waterings or eight three-inch waterings.

TABLE 1A.—RATE AND FREQUENCY OF WATERING, 1926-27 TO 1929-30.

Plot.	Total Water applied per annum.	Number of Applications.	Superphosphate applied per acre per annum.	Yields of Hay per acre (15 per cent. moisture). Season 1926–27, Rainfall 13.04". (4 cuts.)	Season 1927–28, Rainfall 20.83". (5 cuts.)	Season 1928–29, Rainfall 13.39". (5 cuts.)	Season 1929–30, Rainfall 14.62". (5 cuts.)	Average.
	inches.			cwt.	cwt.	cwt.	cwt.	cwt.
1	Nil	..	2 cwt. ..	..	21·33	1·92	13·58	9·21
2	12	6	2 cwt. ..	20·47	54·68	32·81	72·75	45·18
3	18	6	2 cwt. ..	47·05	90·44	90·95	97·21	81·41
4	24	6	2 cwt. ..	67·8	106·99	106·79	106·10	96·92
5	30	6	2 cwt. ..	83·2	120·7	116·12	83·5	100·88
6	30	6	Nil ..	68·1	93·05	72·73	42·95	69·21

Table 1A summarizes the main results from the Watering Test plots laid down in 1925. They confirm the earlier tests, and although there has been a succession of dry seasons, the evidence tends to support the earlier findings that six waterings of 4 inches is the best rate of irrigation, having regard to economy of watering, and yields, quality, and longevity of the lucerne.

(*b*) SPACING OF ROWS TEST.

This section comprised four plots which were designed to test the influence of varying distances between the rows on seed production. Each season the lucerne was allowed to go to seed, then threshed, and the quantity of seed produced from each plot determined. The plots were:—

Plot 1.—Rows 7 inches apart.
,, 2.— ,, 14 ,, ,,
,, 3.— ,, 21 ,, ,,
,, 4.— ,, 28 ,, ,,

The attempt to produce seed at Werribee has not been profitable.

(*c*) "TIME OF CUTTING" TEST.

The object of this test was to determine the best stage at which to cut lucerne. There were three plots, each of which received equal treatment

in every respect, except in regard to the time of cutting. One plot was cut before any blooms appeared, one when one-tenth of the plants were in bloom, and the third when in full bloom. From the "Cut before Blooming" plot six cuts were obtained; from the "Cut one-tenth in Bloom," five cuts; and from the "Cut in Full Bloom," four cuts. The results in the accompanying table show that the greatest yield was obtained from the plot on which the lucerne was cut when one-tenth in bloom. The quality of the hay at that stage is good, but it is not so fine as the hay obtained when cut before blooming. As the bloom develops, the lucerne deteriorates in quality, and when in full bloom the stems are coarse and woody, the leaves are dropping, and the shoots of the new crop are well forward.

For the first and last cuts of the season, the percentage of bloom is not a very reliable guide as to the best time of cutting.

The results of this test are set out in the accompanying table.

TABLE II.—YIELDS PER ACRE OBTAINED FROM VARIOUS PLOTS IN "TIME OF CUTTING" TESTS.

Stage at which Cut.	No. of Cuts obtained per annum.	Yields per Acre.				
		1920–21.	1921–22.	1922–23.	1923–24. (Not Manured.)]	Average for Four Seasons.
		cwt.	cwt.	cwt.	cwt.	cwt.
Before Blooming ..	6	104·6	106·5	127·1	95·9	108·5
One-tenth in Bloom	5	108.2	124·7	142·8	111·1	121·7
Full Bloom ..	4	94·8	123·3	131·6	118·6	117·1

Samples of hay from each cut in the growing season of 1921-22 were analysed. A summary of the results is contained in the following table:—

TABLE III.—ANALYSIS OF SAMPLES OF LUCERNE CUT AT DIFFERENT STAGES OF DEVELOPMENT.

Plot.	Yield.	Protein Content.	Phosphoric Acid.	Lime.	Potash.
	cwt.	per cent.	per cent.	per cent.	per cent.
Cut before Blooming ..	101·1*	18·9	·66	1·31	2·74
Cut 1/10th in Bloom ..	118·6*	15.0	·52	1·12	2·5
Cut in Full Bloom ..	114·8*	14·6	·50	1·23	2·29

* Does not include winter growth.

Hay "cut before blooming" has a higher ash and protein content and a greater nutritive quality. It has a lower fibre content also, an indication of higher digestibility.

(*d*) RENOVATION TESTS.

This test consisted of six plots, two of which were not cultivated at all, two were cultivated in winter and the remaining two in both winter and summer. By weighing the hay from each of these plots it was hoped to measure the benefit obtained from the cultivation.

The results did not disclose any benefit from the scarifying. The evidence available would suggest that if a lucerne stand is free from weeds no benefit results from cultivation. Scarifying in early spring will reduce the amount of annual grasses in the first cut. Liberal manuring is the most effective means of controlling weeds, and maintaining the density of lucerne cut for hay.

(e) Variety Trials.

In this test an attempt was made to ascertain the variety best suited to conditions similar to those existing at Werribee. There is considerable variation in the producing powers of different strains of lucerne, and although there are no well-defined botanical differences between most of the cultivated varieties, they exhibit characters which differentiate them, and some are specially adapted for particular conditions.

Hunter River, an acclimatized Australian variety, occupies the greater part of the lucerne areas of the State. The tests at Werribee have served to demonstrate its productivity, its longevity, and its ability to make moderate growth during the winter months.

Table IV.—Productiveness of Different Varieties of Lucerne at Werribee (1921-1923).

—	Plot.	Yields per Acre.			
		1921–22.	1922–23.	1923–24. (No manure.)	Average.
		cwt.	cwt.	cwt.	cwt.
1	Hunter River ..	135·7	125·9	105·9	122·5
2	French Provence..	122·7	108·3	93·3	108·1
3	South African ..	133·3	119·3	98·9	117·2
4	Japanese ..	103·3	81·8	70·7	85·3
5	Peruvian ..	85·4	75·1	37·1	65·8
6	Hunter River ..	129·3	121·4	119·3	123·4
7	Salt Lake City ..	82·5	75·9	73·6	77·3
8	Spanish ..	102·7	99·2	100·8	100·9
9	Arabian.. ..	86·7	76·5	68·7	77·3
10	Turkestan ..	113·6	108·0	100·0	107·2
11	Hunter River ..	157·0	127·2	116·8	133·7
12	Patagonian ..	110·5	88·2	82·9	93·9
13	Persian	77·8	73·9	63·75	71·8
14	Grimm	133·8	100·8	101·0	111·9
15	Italian	141·9	123·7	105·6	123·7
16	Hunter River ..	148·6	132·7	106·7	129·3

The following table, showing the yields for the last three seasons, contains the results from the new variety tests. The comparative yields again show the high productivity of Hunter River lucerne, but still better returns have been obtained from Marlborough lucerne—a strain from New Zealand:—

Table V.—Yields of Hay (15 per cent. Moisture).

Variety.	1926–27. (4 cut .)	1927–28. (5 cuts.)	1928–29. (5 cuts.)	1929–30. (5 cuts.)	Average.
	cwt.	cwt.	cwt.	cwt.	cwt.
Hunter River	52·2	86·6	122.4	95·4	89·1
Argentine	49.9	86·4	118·9	90·0	86·3
Dakota	47·6	88·8	117·7	94·1	87·0
French Provence.. ..	46·5	79·6	114·9	98·4	84·8
Hunter River	44·9	84·4	121·7	98·4	87·3
Grimm	36·3	85·7	112.6	83·2	79·4
Kansas	42·6	83·2	117·2	88·1	82·8
Marlborough	53·6	93·6	128·1	109·8	96·2
Peruvian	59·8	81·4	116·3	83·9	85·3
Hunter River	58·2	89·1	123·9	104·6	93·9

It cannot be claimed that Hunter River lucerne is of the finest quality; in fact, it is inferior to several of the varieties under trial, but properly handled it will produce first-class hay. French Provence is a popular variety, and it is more leafy and its stems finer than those of Hunter River. It is probable that its quality compensates for its reduced yield as compared with Hunter River.

Some lucernes are dormant during the winter months. This is a notable feature of Japanese and Grimm varieties. Others, such as Peruvian, Arabian, and Persian, make relatively good growth during the cooler parts of the year, but in aggregate yield they fall far behind Hunter River.

In regard to the life of the lucerne stand, some differences were apparent in the plots at Werribee, *e.g.*, Arabian lucerne appeared to be very short-lived, and soon presented a very sparse stand; and it will be noticed that Peruvian lucerne falls off in yield after the first season.

The Peruvian and Persian plots were thin, and the absence of growth in the Japanese and Grimm plots during winter permitted the spread of weeds, which militated against the proper development of the lucerne.

(*f*) Fertilizer Tests on Lucerne.

Judicious manuring of the lucerne stand plays an important part in the production of profitable yields. The use of fertilizer at seeding helps to ensure success, particularly if dry or unfavorable conditions for the young plants prevail, and the regular top-dressing of the older lucerne is profitable except on the most fertile soil.

Besides augmenting yields, manuring supplies a means of making lucerne more palatable. It enriches the fodder, and has often a marked effect on the health of stock. Lucerne reduces the mortality of flocks grazed on it. Such grazing invigorates the plants and enables them to better withstand further grazing, and to compete with aggressive weeds; the useful life of the stand is prolonged and the growing period extended by top-dressing.

The removal of big crops of lucerne makes a heavy draught on the plant food of the soil. Analyses of the hay produced at Werribee in the season 1921-22 under normal conditions as regards irrigation, time of cutting, &c., showed that a six-ton crop contained 320 lbs. nitrogen, 150 lbs. lime, 70 lbs. phosphoric acid, and 335 lbs. potash.

Lucerne with its deep-rooting system is able to draw its plant food from considerable depth, and at Werribee very high yields have been obtained even without manure, but still the use of fertilizers has induced extra returns considerably in excess of the cost of application.

Experiments have been carried on at the Werribee Research Farm for several years to test the influence of fertilizers applied in varying quantities and in different combinations. The results have served to emphasize several points:—

(1) The value of soluble phosphatic manure.

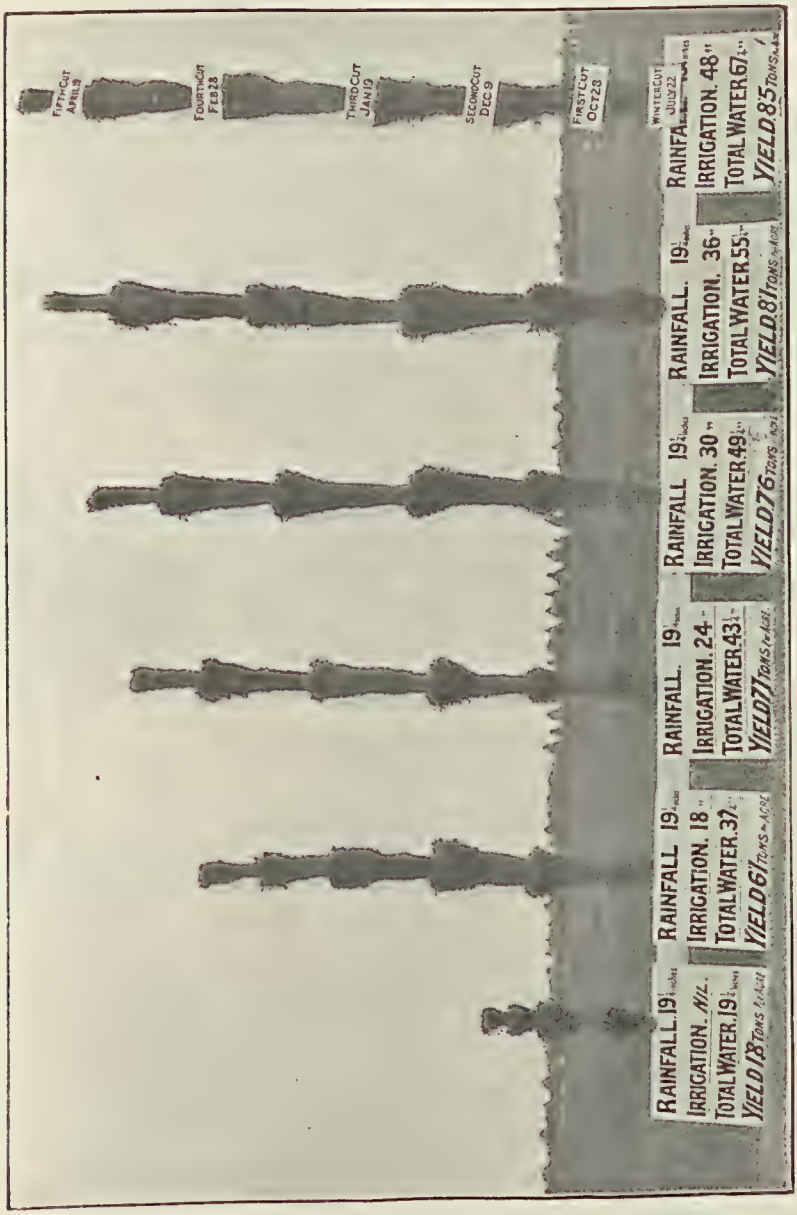
(2) The value of stable manure, particularly in combination with lime.

(3) The unprofitableness of using nitrogenous or potassic manure.

TABLE VI.—YIELDS OF HAY OBTAINED FOR THE THREE SEASONS 1926-27 TO 1928-29.

No.	Plot.	Season 1926–27.	Season 1927–28.	Season 1928–29.	Average Yield per Acre for Three Seasons (15 per cent. Moisture).
		cwt.	cwt.	cwt.	cwt.
1	Border plot	..	..	..	..
2	No manure	37·55	80·0	92·1	69·9
3	Super. 1 cwt. (August)	42·0	83·6	102·4	76·0
4	Super. 1 cwt. (January) ..	42·2	83·4	105·4	77·0
5	No manure	41·3	80·3	87·3	69·6
6	Super. 2 cwt.	46·6	91·2	114·5	84·1
7	Super. 2 cwt. (one in August, one in January)	45·7	88·0	116·0	83·2
8	No manure	44·8	84·2	94·4	74·5
9	Super. 3 cwt.	50·2	95·8	123·8	89·9
10	Super. 3 cwt. (two in August, one in January)	47·8	96·3	124·9	89·7
11	No manure	47·3	89·2	106·9	81·1
12	Super. 4 cwt.	49·1	94·3	127·9	90·4
13	Super. 4 cwt. (two in August, two in January)	47·2	90·5	121·9	86·5
14	No manure	47·3	89·7	111·8	82·9
15	Super. 6 cwt. (three in August, three in January)	46·3	92·0	124·2	87·5
16	Super. 2 cwt.	51·3	95·3	126·2	90·9
17	No manure	54·1	91·3	119·6	88·3
18	Super. 2 cwt., Gypsum 1 ton ..	55·8	99·0	131·8	95·5
19	Super. 4 cwt., Gypsum 1 ton ..	62·2	104·8	144·2	103·7
20	No manure	56·1	96·9	126·2	93·1
21	Super, 6 cwt., Gypsum 1 ton ..	60·0	103·0	144·9	102·6
22	Super. 2 cwt., Gypsum 1 ton (at seeding)	50·9	94·8	129·9	91·8
23	No manure	53·7	91·5	121·7	89·0
24	Gypsum 1 ton	54·2	91·2	121·9	89·1
25	Sulphur 1 cwt.	50·8	89·1	110·3	83·4
26	No manure	54·4	91·1	118·6	88·0
27	Super. 2 cwt., Gypsum 1 ton ..	64·7	103·4	139·6	102·6
28	Super. 2 cwt., Sulphur = 1 ton Gypsum	62·1	98·7	131·0	97·3
29	No manure	64·4	93·5	125·3	94·4
30	Super, 2 cwt.	68·8	103·4	138·7	103·6
31	Super. 2 cwt., Lime ½ ton ..	62·3	99·1	136·1	99·2
32	No manure	58·1	95·2	126·6	93·3
33	Super. 2 cwt., Lime 1 ton ..	57·4	92·9	126·1	92·1
34	Super. 2 cwt., Gypsum 1 ton ..	58·7	96·0	130·9	95·2
35	No manure	53·3	89·5	114·0	85·6
36	Super. 2 cwt., Nitrate of Soda 1 cwt.	52·7	91·3	124·3	89·4
37	Super. 2 cwt., Nitrate of Soda 1 cwt., Potash 1 cwt.	51·8	92·1	128·2	90·7
38	No manure	51·3	88·6	116·3	85·4
39	Super. 2 cwt.	58·3	93·0	133·5	94·9
40	Triple Super. = 2 cwt. Super ..	61·3	94·3	131·3	95·6
41	No manure	59·5	91·8	123·4	91·6
42	Basic Slag 2 cwt.	54·5	86·5	120·0	87·0
43	Ground Rock Phosphate 2 cwt. ..	48·3	82·9	121·4	84·2
44	No manure	44·7	75·3	106·4	75·5
45	Rock Phosphate 2 cwt., Sulphur = 1 ton Gypsum	43·6	76·7	110·7	77·0
46	Rock Phosphate 2 cwt., Gypsum 1 ton	49.3	81.7	109.7	80.2
47	No manure	41.0	74.2	100.8	72.0

Superphosphate may be set down as the most effective manure, and 2 cwt. per acre may be advocated as an annual top-dressing. However, as much as 4 cwt. of superphosphate, which would replace all the phosphoric acid removed, may be profitably used.



Lucerne Poles illustrating Yield of Lucerne Hay from Application of Varying Quantities of Water.

Top-dressing with gypsum appears to be more advantageous than equivalent amounts of calcium in the form of ground limestone or burnt lime. Potassium sulphate fails to produce increased returns at

Werribee. Applications of sulphur do not result in increased yields of lucerne.

Insoluble phosphatic manures, rock phosphate, basic slag, and bone fertilizer fail to produce results comparable to those obtained with superphosphate.

Lucerne—Irrigated Area.

Lucerne thrives well under irrigation at Werribee, and yields up to 6½ tons per acre have been obtained in favorable seasons.

Up to the present 200 acres of land on the farm have been sown to this crop. This area has been carefully graded, and is divided into a series of "bays" by a system of parallel check banks running in the direction of the greatest slope of the land. The "bays" are from 5 to 20 chains long, and from two-thirds to 1 chain wide. The water is allowed to flow down each bay in succession. The slope of the land averages 2 inches to the chain.

The water used is derived by gravitation from the Exford Weir—the capacity of which is 17,000 acre-feet.

Portion of the area is grazed to sheep and dairy cows, and the remainder is cut for hay.

Irrigated Grasses.

Permanent pastures now occupy a major part of the irrigated area of the farm. This development followed on the experience gained from the tests with grasses and clovers instituted when the farm was founded. As the lucerne thinned out, it has been replaced by sown pastures, because they have been found suitable for irrigated conditions, and are productive, long-lived, and are palatable to stock.

Pastures have proved much better adapted for grazing than lucerne.

The test plots laid down in 1925 comprise—

(*a*) Variety tests.
(*b*) Manurial tests.
(*c*) Rate and frequency of watering tests.

These tests correspond to those conducted with lucerne, but, whereas hay yields are a suitable measure of the production of lucerne under varied treatments, the production from pastures is not so easily determined.

Sheep carrying capacity and production of green grass clippings have now been adopted and promise satisfactory results.

The several manurial plots and the yields of green clippings obtained from them last season are indicated on the following page.

For convenience and to test the consistency of the results, each manured plot is subdivided into nine sections. These mowed plots have their exact counterpart in an adjoining section, which is grazed at regular intervals. When the plots are mowed samples are taken for chemical analysis.

At intervals botanical analyses of the pasture are made to get a picture of the changing composition. The method adopted is the percentage estimation method.

IRRIGATED PASTURE TESTS.

SUMMARY OF MANURIAL PLOTS—SEASON 1929-30.

No.	Plot.	Yields of Dry Matter in lb. per Plot.												Area of Plot=1/20th acre approx. Green Grass (80% moisture).		
		1st Cut. 17.9.29.	2nd Cut. 15.10.29.	3rd Cut. 7.11.29.	4th Cut. 29.11.29.	5th Cut. 24.12.29.	6th Cut. 13.1.30.	7th Cut. 4.2.30.	8th Cut. 25.2.30.	9th Cut. 18.3.30.	10th Cut. 14.4.30.	11th Cut. 25.6.30.	Total Yield Dry Matter per Plot.	Total Yield of Green Grass (80 % moisture).	Adjusted No. Manure Values.	Increase or Decrease compared with *No Manure*.
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	No Manure ..	50·0	37·9	27·5	20·8	49·7	25·9	24·3	23·9	16·7	15·0	4·4	296·1	1,480·5	..	..
2	Super. 1 cwt. per acre	78·9	54·0	36·9	42·3	73·0	39·8	39·1	37·5	26·0	21·5	10·7	459·7	2,298·5	1,537·5	761·0
3	Super. 2 cwt. per acre	78·6	55·1	38·9	48·6	86·6	49·4	60·9	53·7	37·8	31·2	18·9	559·7	2,798·5	1,594·5	1,204·0
4	Super. 3 cwt. per acre	89·4	54·9	40·4	57·1	99·3	57·2	79·1	66·3	48·2	44·9	24·2	661·2	3,306·0	1,651·5	1,654·5
5	Super. 4 cwt. per acre	90·2	56·9	43·7	64·6	106·4	61·0	94·7	72·9	52·6	50·0	27·0	720·0	3,600·0	1,708·5	1,891·5
6	No Manure ..	53·8	42·8	30·0	28·3	57·1	31·0	31·7	34·5	20·9	18·4	4·67	353·2	1,766·0	..	..
7	Basic Slag 2 cwt. per acre	91·6	55·1	42·5	51·2	80·2	49·7	66·4	54·3	37·4	31·1	10·4	569·9	2,849·5	1,848·0	1,001·5
8	Rock Phosphate 2 cwt. per acre	74·5	47·2	36·3	35·2	70·4	39·5	47·6	45·2	31·1	25·4	6·7	458·2	2,291·0	1,930·0	361·0
9	Nitrate of Soda 1 cwt.	78·3	45·7	34·4	27·3	56·5	32·1	38·3	37·3	22·9	18·6	9·35	400·8	2,004·0	2,012·0	— 8·0*
10	Ammonium Sulphate 1 cwt.	96·3	43·8	33·6	31·0	58·8	32·6	37·7	38·8	23·7	19·6	9·2	425·1	2,125·5	2,094·0	31·5
11	Sup. 2 cwt., Nit. Soda 1 cwt.	124·9	47·1	39·7	43·8	80·8	46·7	66·7	54·5	38·7	32·4	23·8	599·1	2,995·5	2,176·0	819·5
12	Sup. 2 cwt., Amm. Sulph. 1 cwt. ..	128·2	46·3	37·9	41·0	74·9	45·3	63·7	52·5	36·9	32·8	22·9	582·4	2,912·0	2,258·0	654·0
13	No Manure ..	95·3	51·6	38·5	35·9	68·6	37·5	45·3	43·2	26·5	20·6	4·7	467·7	2,338·5	..	..
14	Pot. Sulph. 1 cwt. ..	93·1	52·9	38·8	36·4	65·5	35·1	43·7	43·4	24·1	19·0	6·2	449·2	2,246·0	2,352·5	— 106·5*
15	Sup. 2 cwt., Pot. Sulph. 1 cwt.	118·5	57·7	46·8	57·7	92·6	51·2	79·2	62·7	42·5	33·9	24·2	667·0	3,335·0	2,366·5	968·5
16	Sup. 2 cwt., Pot. 1 cwt., Amm. Sulph. 1 cwt.	120·4	51·7	40·4	44·3	78·1	44·3	65·1	55·5	38·0	33·9	23·8	595·5	2,977·5	2,380·5	597·0
17	Sup. 2 cwt., Lime 30 cwt.	112·8	57·4	44·6	56·2	92·6	56·7	86·2	64·9	47·3	42·3	24·8	685·8	3,429·0	2,394·5	1,034·5
18	Super. 2 cwt., Gypsum 30 cwt.	120·2	61·9	55·2	60·2	90·5	57·6	85·9	63·9	44·5	40·8	23·5	704·2	3,521·0	2,408·5	1,112·5
19	No Manure ..	103·2	61·3	44·7	41·0	61·2	37·7	42·4	40·8	23·0	21·2	7·8	484·3	2,421·5	..	..

* Decrease.

IRRIGATED PASTURE TESTS.

RATE AND FREQUENCY OF WATERING—SEASON 1929–30.

Area of Plot = $\frac{1}{8}$ Acre.

No.	Plot.	Yields of Dry Matter in lb. per Plot.											Total yield lb. per Plot Green Grass.	Increase over no Water Plot.	Increase per acre inch of Water.
		1st Cut 3.10.29 to 9.10.29.	2nd Cut 31.10.29 to 4.11.29.	3rd Cut 21.11.29 to 27.11.29.	4th Cut 19.12.29 to 20.12.29.	5th Cut 6.1.30 to 7.1.30.	6th Cut 28.1.30 to 29.1.30.	7th Cut 17.2.30 to 18.2.30.	8th Cut 10.3.30 to 11.3.30.	9th Cut 11.4.30 to 12.4.30.	10th Cut 23.6.30 to 24.6.30.	Total yield per Plot in lb. Dry Matter	80% Moisture.		
1	6 waterings of 3 inches ..	149·18	122·14	61·49	86·28	76·68	64·61	68·62	105·42	54·50	66·0	854·92	4,274·6	2,564·1	142·4
2	6 waterings of 4 inches ..	176·64	215·62	91·07	117·18	108·30	81·52	94·29	112·47	71·71	76·10	1,142·90	5,714·5	4,004·0	166·8
3	6 waterings of 5 inches ..	181·00	200·69	96·93	114·89	110·31	66·82	118·60	116·08	63·31	78·40	1,147·03	5,735·1	4,024·6	134·1
4	6 waterings of 6 inches ..	194·30	233·16	98·59	112·97	111·68	69·63	88·87	118·77	60·82	63·90	1,161·69	5,808·4	4,097·9	113·8
5	No water	109·6	45·02	28·25	26·58	27·27	12·77	..	28·75	10·66	53·20	342·10	1,710·5	..	..
6	5 waterings of 6 inches ..	118·40	194·94	86·46	93·38	47·26	69·10	86·16	116·25	74·24	87·50	973·69	4,868·4	3,157·9	105·2
7	4 waterings of 6 inches ..	211·40	182·35	89·21	77·38	53·91	55·14	13·00	53·83	62·49	116·50	915·21	4,576·0	2,865·5	119·4
8	3 waterings of 6 inches ..	125·10	180·68	85·45	59·27	59·67	47·79	50·29	57·66	26·02	85·90	777·83	3,889·1	2,178·6	121·0
9	8 waterings of 3 inches ..	208·71	145·90	89·90	83·23	84·25	68·87	60·83	91·86	145·02	98·20	1,076·66	5,383·3	3,672·8	153·0

* Botanical Surveys taken between the Cuts Nos. 3 and 4, 6 and 7, 9 and 10.

Rate and Frequency of Watering Tests.

In the rate and frequency of watering tests the plots are ¼ acre in area, one-half of this area being mowed. Each plot is divided into five sections.

The yields of green clippings from each plot are shown (see table on previous page), but these results are incomplete without a statement of the botanical composition of the herbage, and in this section also regular examinations are made to determine the relative amount of the different species.

A 2½-acre section has been laid out for an extension of the manurial tests on pastures, particularly as regards the value of nitrogen, and an area of ½ acre has been fenced off in No. 5 S.W. and subdivided into 43 plots. Every alternate plot will receive sulphate of ammonia at particular periods of the year, and the influence of these dressings will be traced by mowing the grasses at the grazing stage.

Rotational Grazing Tests.

A new series of tests has been instituted in Paddock No. 12 S.E., where a 10-acre paddock has been subdivided to test the influence of two different systems of grazing on carrying capacity and condition of the pasture.

In one portion, 5 acres is divided into two, and each half is grazed alternately for ten days. The other portion of 5 acres is subdivided into ten ½-acre lots, and each of these is grazed for two days in rotation.

The pasture on the area was fourteen years old. Perennial Rye grass and Kentucky Blue grass were spread throughout, while Cocksfoot was fairly well represented. White clover, Strawberry clover, and Subterranean clover were well distributed. The manurial treatment was an autumn dressing of 2 cwt. of superphosphate.

Before commencing the tests the whole area was grazed short. The tests were commenced in November, when 60 sheep were put in each section. These were two-tooth wethers.

The most notable feature of the tests has been that under the controlled grazing, permitted by the subdivision, the carrying capacity has been surprisingly high. The sheep have been maintained in prime condition, and up to fourteen per acre were grazing the small areas during the summer, and in July eight sheep per acre were carried comfortably.

The sheep have been weighed at intervals of ten days and their progress recorded. Botanical surveys are made at intervals and a method of sampling by clipping is being tested. It is hoped this will give a measure of growth, the seasonal variation, the amount eaten by the sheep, their preference for particular species, and the difference in the growth of the pastures under the two systems of grazing.

The total area of irrigated grasses now established on the farm is approximately 300 acres, and contains the following mixture of grasses and clovers:—

English rye grass	12 to 14 lb. per acre.
Cocksfoot	3 to 5 lb. per acre.
Alsike clover	1 to 2 lb. per acre.
Red clover	1 to 2 lb. per acre.
White clover	1 to 2 lb. per acre.
Strawberry clover	1 lb. per acre.
Subterranean clover	1 to 2 lb. per acre.
Totals	20 to 27 lb. per acre.

The first mixture, i.e., 20 lb. per acre, is usually ample, provided the soil conditions at seeding are satisfactory.

FARM LIVE STOCK.

At the present time (September, 1930), the farm live stock maintained on the farm are—

Dairy Cattle—	
Red Polls	132
Friesians	37
Horses—	
Clydesdales	98
Light horses	4
Sheep and Lambs—	
Stud Suffolks	750
Ryelands	40
Cross-breds	760
Poultry (including chickens)	3,000

Dairy Cattle.

The "Victoria" Stud of Red Poll cattle was founded by the Department of Agriculture in 1909, and was transferred to Werribee in 1913. The "Victoria" Friesian Stud was begun in 1918 by the importation of some members of high producing strains from the New Zealand Government. Four cows (one Red Poll and three Friesians) produced over 500 lb. of butter-fat during 1929-30 in 273 days.

Red Polls.

The Red Poll cattle are recognized as being ideal dual purpose cattle, and are gaining in popularity in Australia each year.

The Red Poll bull calves have been distributed widely throughout the State. They are sold on the basis of 1s. per pound of butter-fat produced by the dam in her best lactation.

The Red Poll herd sire is Dominion Bright Belgian, who was imported from the New Zealand Government in July, 1929, and who is descended from stock originally exported from here in 1918. Other Red Poll sires in use in the stud are Victoria Volcano 322A, Victoria Royal Ringer 818AA, and Victoria Major Royal 817AA.

Friesians.

Friesian cows are recognized as being heavy milkers, and this fact has again been verified by the herd, tested at Werribee during the past twelve months, when the average milk production of the herd was 1,183 lb. of milk per cow in 273 days.

The Friesian herd sires are Victoria Joyous Mercedes (985) and Dominion Oakdale (342).

Victoria Songbelle (1708).

Born 25.8.23.

Champion Fresian Cow, Melbourne Royal Show, 1929.

Milk and Butter Fat Records (273 days).

Date Calved.	Milk.	Av. Test.	Butter Fat.	Standard.
	lb.		lb.	lb.
18.10.26	9,306	3·65	339	250
8.9.27	11,057	3·27	362	300
20.8.28	17,013	3.23	549	325
23.8.29	17,168	3·13	537	350

14.8.29 producing 8¼ gallons of milk daily at present.

Victoria Reparation (796B).

Born 4th July, 1921.

First Prize, Type and Utility Division, Melbourne Royal Show, 1928 and 1929; Second Prize, 1929; and Third Prize, 1928, in the *Weekly Times* Champion Milk and Butter Fat Test, Melbourne Royal Show.

Milk and Butter Fat Records (273 days).

Date Calved.	Milk. lb.	Test.	Butter Fat. lb.	Standard. lb.
18.8.23	8,551	3·74	319	200
4.9.24	11,265	3·55	400	250
17.11.25	11,796	3·88	458	300
7.2.27	12,111	3·93	476	350
16.8.28	14,646	3·69	540	350
5.9.29	13,717	3·58	491	350

MILK AND BUTTER-FAT RECORDS—273 DAYS, 1929-30.

The amount of butter-fat required for qualification varies according to the age of the animal (up to 5 years old) at the time of calving, the standard for 273 days being as follows:—

Junior 2-year-old (under 2½ years at time of calving) ..	200 lb. butter fat.
Senior 2-year-old (between 2½ and 3 years)	225 lb. butter fat.
Junior 3-year-old (between 3 and 3½ years)	250 lb. butter fat.
Senior 3-year-old (between 3½ and 4 years)	275 lb. butter fat.
Junior 4-year-old (between 4 and 4½ years)	300 lb. butter fat.
Senior 4-year-old (between 4 and 4½ years)	325 lb. butter fat.
Mature cow (5 years old or over at time of calving) ..	350 lb. butter fat.

RED POLLS.

Name.	Milk.	Test.	Fat.
	lb.		lb.
Mature Cows—Standard 350 lb. Butter Fat.			
Victoria Joan of Arc (1244B)	11,988	4·75	569·15
Victoria Reparation (796B)	13,717	3·58	491·39
Nictitana (311B)	10,514	4·41	463·66
Victoria Fez (1155A)	12,016	3·83	459·64
Victoria Cutty Sulu (1284C)	9,912	4·63	459·35
Victoria Bright Eye (788B)	8,172	5·29	432·01
Gelderlana A (387C)	10,646	4·06	431·77
Cutty Sark (383C)	10,697	3·92	419·38
Victoria Blue Ribbon (1149A)	8,933	4·54	405·18
Victoria Distant View (1152A)	8,925	4·49	401·06
Victoria Euphrates (716A)	9,695	4·07	394·36
Victoria Basra (1145A)	7,586	5·06	383·71
Victoria Coronation (792B)	9,626	3·88	373·05
War Wings (259A)	8,648	4·31	372·93
Victoria Stripe (723A)	9,398	3·84	360·83
Victoria Cutaway (1241B)	8,307	4·29	356·35
Victoria La Regal (718A)	8,953	3·95	353·27
Victoria Avesta (1142A)	7,605	4·54	345·11
Victoria Velbelle (966AA)	7,650	4·16	317·88
Victoria Rose Regal (560AA)	7,673	4·05	310·95
Average for Mature Cows	9,533	4·28	405·05
Senior 4-year-old Cows—Standard 325 lb. Butter Fat.			
Victoria Amara (1649A)	9,080	4·91	445·39
Victoria Ghetto (1956A)	9,261	4·26	394·74
Average for Senior 4-year-old Cows	9,171	4·59	420·07
Senior 3-year-old Heifer—Standard 275 lb. Butter Fat.			
Victoria Picquette (1668A)	9,532	4·03	384·07
Junior 3-year-old Heifers—Standard 250 lb. Butter Fat.			
Victoria Braid (1654A)	7,392	4·31	318·25
Victoria White Rose (1523AA)	6,206	4·74	294·18
Average for Junior 3-year-old Heifers	6,799	4·53	306·22
Senior 2-year-old Heifers—Standard 225 lb. Butter Fat.			
Victoria Cutty Spark (1756B)	8,987	4·46	400·90
Victoria Village Belle (1522AA)	8,441	4·23	356·80
Victoria Nectar (1665A)	7,539	4·68	352·90
Victoria Cross (2313A)	7,004	4·82	337·72
Victoria Velvet Curl (1521AA)	6,663	5·02	334·32
Victoria Smoke Ring (2337A)	6,320	5·21	329·54
Victoria Eruption (2316A)	8,376	3·61	301·91
Average for Senior 2-year-old Heifers	7,613	4·58	344·88

Red Polls—*continued.*

Name.	Milk.	Test.	Fat.
	lb.		lb.
Junior 2-year-old Heifers—Standard 200 lb. Butter Fat.			
Victoria Balmy Breeze (2302A)	7,659	4·58	351·00
Victoria Seaside Air (2336A)	5,462	5·22	284·88
Average for Junior 2-year-old Heifers	6,561	4·90	317·94

FRIESIANS.

Mature Cows—Standard 350 lb. Butter Fat.

Victoria Songbelle (1708)	17,168	3·13	537·36
Victoria Patchwork (1706)	14,303	3·69	527·85
Victoria Lean Patch (1705)	14,145	3·58	506·48
Dominion Woodnymph (988)	12,524	2·69	336·70
Average for Mature Cows	14,535	3·27	477·10

Senior 4-year-old Cow—Standard 325 lb. Butter Fat.

Victoria Carina (2065)	10,639	3·67	390·92

Senior 3-year-old Heifers—Standard 275 lb. Butter Fat.

Victoria Piebe (3262)	11,924	3·36	401·13
Victoria Top Patch (2634)	8,496	3·74	317·99
Average for Senior 2-year-old Heifers	10,210	3·55	359·56

Senior 2-year-old Heifers—Standard 225 lb. Butter Fat.

Victoria Wedding Oak (3269)	10,262	3·32	340·56
Victoria Ilka Patch (2957)	10,243	3·15	322·47
Average for Senior 2-year-old Heifers	10,253	3·25	331·52

Junior 2-year-old Heifer—Standard 200 lb. Butter Fat.

Victoria Skirt (3264)	8,607	3·64	313·07

HERD AVERAGES, 1929–30.

Red Polls.			
34 Cows without allowances	8,782	4·40	381·99
34 Cows averaged with allowances (butter fat only)	..	..	443·11
Friesians.			
10 Cows averaged without allowances	11,831	3·40	399·45
10 Cows averaged with allowances (butter fat only)	..	..	456·95

The Friesian cows Victoria Lean Patch and Victoria Freemartin have just completed their 273 days' tests for the year 1930-31, and their respective records are 19,682 lb. milk, 3.55 average test, and 700 lb. butter fat, and 20,641 lb. milk, 3.20 average test, and 660 lb. butter fat.

Victoria Joan of Arc (4244B).

Born 6th March, 1924.

Never exhibited.

Milk and Butter Fat Records.

Date Calved.	Milk.	Test.	Butter Fat.	Standard.
	lb.		lb.	lb.
27.5.27	7,664	4.62	354	250
26.5.28	8,885	4.98	443	300
19*7.29	11,988	4*75	569	350

14.7.30 producing 6 gallons of milk daily at present.

Red Polls.

HORSES.

The whole of the horses on the Farm are now pedigree Clydesdales. Many were sired by Baron Wigton (C.S.B. 13884). An addition to the Research Farm stud was made in 1926 by the purchase of the Clydesdale colt Widgiewa Norval (C.C.S.B. 956). Victoria Flash Brilliant (C.C.S.B. 1036), bred on the farm, foaled on the 25th October, 1926, is also a member of this stud.

Special Stud Mares.

(1) Patricia (N.Z. C.S.B. 1604), and (2) Lucilla (N.Z. C.S.B. 1605).

Patricia has had a rare winning record, and was champion at the Melbourne Royal Show in 1917 and 1918, while Lucilla had also a long winning career in New Zealand, and has scored honors as a brood mare at the Melbourne Royal Show. There are at present 50 mares on the farm registered in the Australian Clydesdale Stud Book.

SHEEP.

Suffolks.

The Farm flock of stud Suffolk sheep now numbers 750, including the present season's crop of lambs. The chief features of this breed as borne out by our experience on the Farm are:—(*a*) Mutton

Four-tooth Suffolk Ram bred on the Farm.

producing qualities; (*b*) early maturity; (*c*) fat lamb raising qualities; (*d*) prolificacy. The average lambing of the stud flock for the past fifteen years has been approximately 150 per cent. The Farm has been successful in gaining many Champion and Reserve Championships with both ewes and rams at the Sheep-breeders' and Melbourne Royal Shows since the establishment of the flock in 1914.

Suffolk Ewes bred on the Farm.

Ryeland Ewe.

Ryelands.

Ten ewes and two rams were imported from New Zealand in July, 1925. As a comparatively new breed to Australia, the results to date at the Research Farm justify the continuance of the stud.

The feature of the breed is its apparent dual purpose qualities. The lambs are very blocky and mature to suitable weights quickly. Experience at Werribee shows that the Ryeland crosses well with suitable ewes for fat lamb-raising.

POULTRY.

A high-class pedigreed poultry flock was established by the Department in 1912, and was transferred to Werribee in 1919.

The birds are housed in an up-to-date method, which provides for a section of 24 breeding pens, 130 pens for single testing and experimental work, a brooder house (60 feet x 15 feet) heated with hot-water pipes, a chicken-house (60 feet x 15 feet), a laying shed to accommodate 450 hens, shed to accommodate 500 pullets for feed experiments, feed-room and grain silos, store-room, workshop, egg-room, office, and incubator room with incubator capacity for 1,800 eggs.

The stock consists of 150 stud Leghorns, all of them bred from tested stock. Their quality is denoted by the fact that the official record for six white Leghorn hens for twelve months' laying is held by a team bred from a setting of eggs sold from this flock. These six birds laid 1,699 eggs at the Burnley competition, and they were afterwards sold for £75. During the 1924-25 season, one pullet in the single-test pen laid 333 eggs, and another 306.

The Utility Black Orpingtons consist of a stud flock of 150 birds, also bred from tested stock. Many of them are of the same line of blood as the team that won the 1922-23 Burnley competition. This team laid 1,602 eggs for the twelve months, and also established an official world's record for winter test by laying 579 eggs in 122 days.

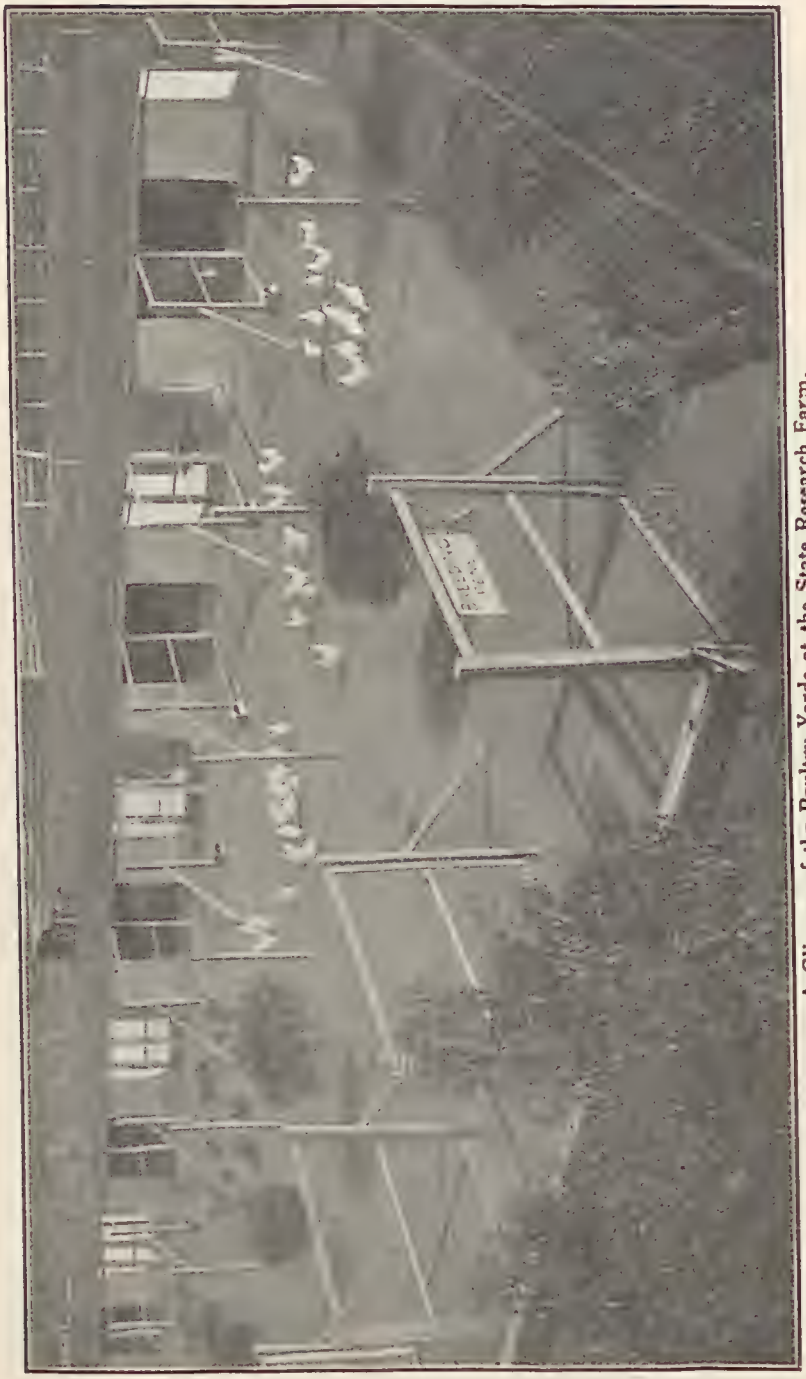
Approximately 1,500 birds are now being used for breeding experiments, feeding experiments, and for egg production.

At the present time (September, 1930), there are 1,500 chickens, hatched this season, all of which have been individually branded to enable an accurate record of their pedigrees to be kept.

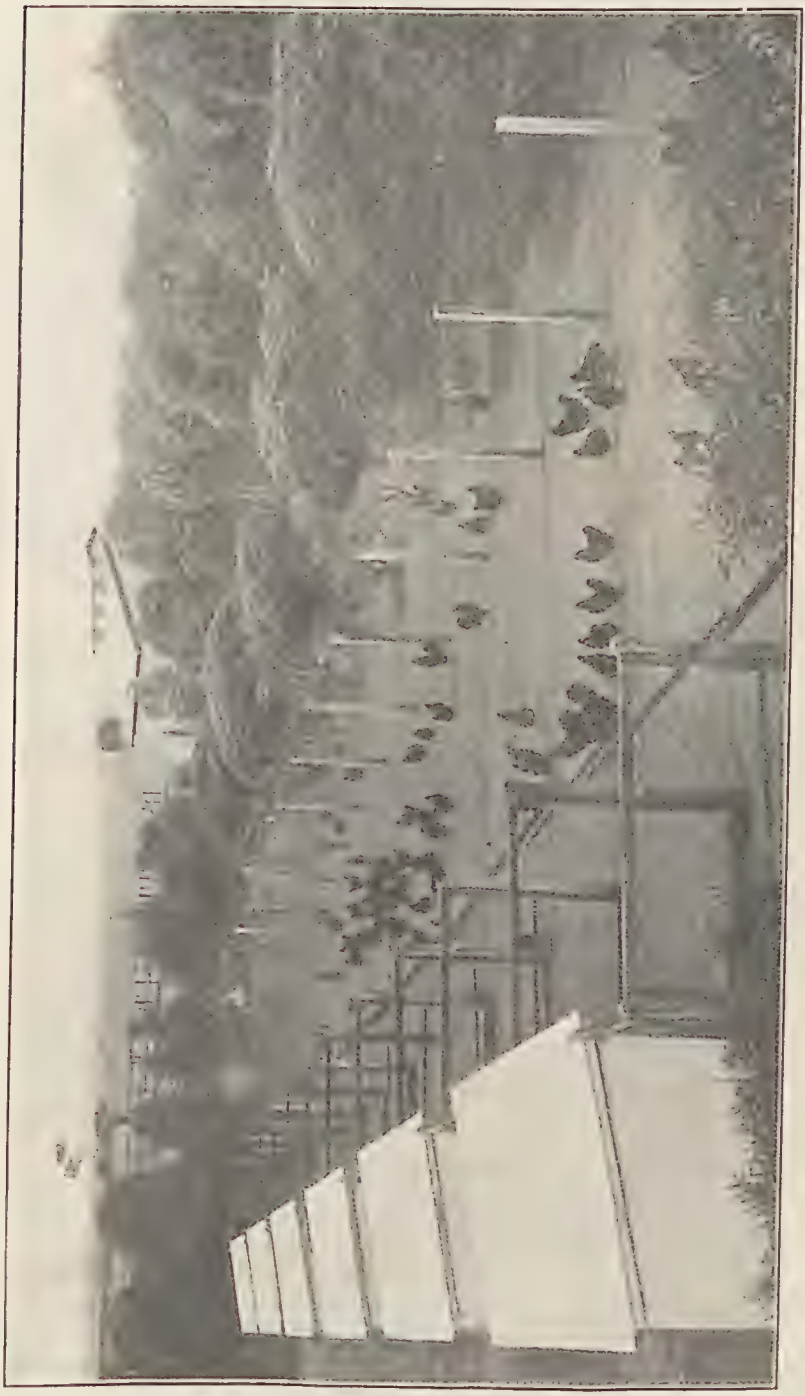
Feeding Experiments.

(1) Free Choice, Dry Mash and Wet Mash.

Some time since, an experiment was carried out to test the advisability of allowing White Leghorns a free choice of the various foods—usually fed to birds for egg production, as compared with two



A Glimpse of the Poultry Yards at the State Research Farm.



Australorps. State Research Farm, Werribee, Victoria, Australia.

other systems of feeding in operation at the State Research Farm, namely—

(*a*) Dry mash kept in hoppers always available, chaffed green stuff given at mid-day and grain fed at night in the litter.

(*b*) Wet mash fed in troughs in the morning, chaffed green stuff at mid-day and grain fed in the litter at night.

Summary.

Pen.	Average No. of Eggs per Bird.	Return per Bird.	Mash.	Cost Grain.	Total.	Profit over Cost of Feed.
		£ s. d.	s. d.	s. d.	s. d.	s. d.
No. 1.—Free Choice ..	173·64	1 1 6¾	1 4½	4 11½	6 4	15 2¾
No. 2.—Dry Mash ..	169·47	1 0 6½	2 3¾	3 11¼	6 3	14 3½
No. 3.—Wet Mash ..	180·64	1 2 4¾	2 5¼	3 8½	6 1¾	16 3

Conclusions.

The results obtained in this experiment with the No. 1 Pen (Free Choice) indicate that White Leghorns can be trusted to balance their own ration and produce eggs economically.

Although they laid seven eggs per bird less, and cost 2¼d. per bird more to feed for the twelve months than the pen fed on the wet mash. it must be remembered that there was a considerable saving in labour in the feeding of the No. 1 Pen, as the feed hoppers had to be replenished on an average only twice a month; whereas, the wet mash for No. 3 Pen had to be prepared and fed to the birds every morning, and the grain mixed and fed to them every evening.

A reference to the table showing the monthly food consumption should be sufficient to break down the prejudice existing amongst a number of poultry-keepers against the use of Algerian oats. The oats used in this experiment were only fair average quality feed oats, straight from the harvester, not clipped or graded; yet the birds in No. 1 (Free Choice) Pen ate more of them than of either maize or barley.

It was very noticeable during the test that the quantity of maize consumed varied with the weather. The highest consumption for the year was in July, which was the coldest and wettest month of the Test.

Rape seed meal was not placed in the pen till 1st August. From that date till the end of the test, there was only one month in which they did not eat some of it. This meal is readily eaten by the birds when placed in the dry mash.

The fact that the birds in No. 1 Pen (Free Choice) consumed 1,556 lb. more grain than mash may be accounted for by the cold weather during the winter and by the very mild summer.

It was noted that the No. 1 Pen (Free Choice) consumed a much larger quantity of green stuff than either of the other two pens, and a considerable portion of it was eaten the last thing before the birds went to roost. In view of this fact, it was decided to feed green stuff after the grain feed at night to all the birds at the Research Farm, and this has resulted in a great improvement in the number of eggs laid.

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Sow 4 lbs. per acre broadcast, or 7 lbs. in drills; **4d.** lb.; **35/-** cwt.

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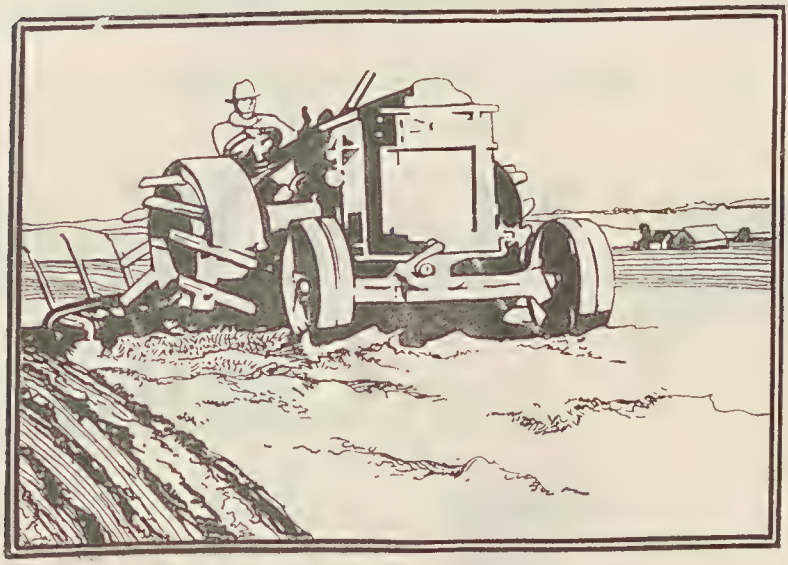

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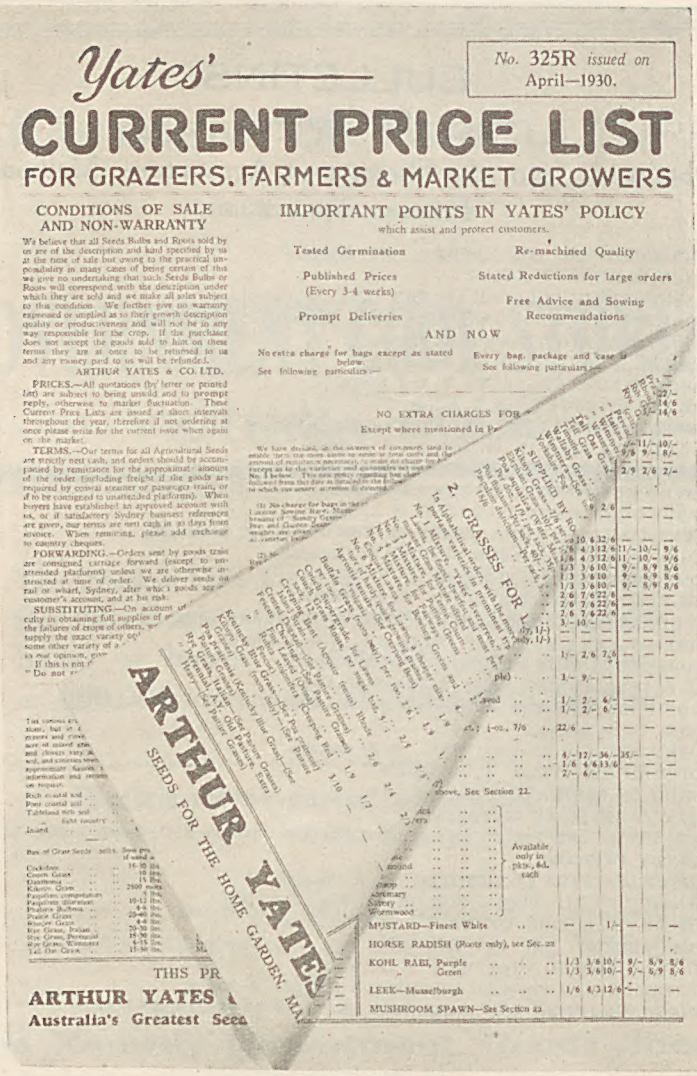

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